The
Geographical Journal.

No. 2. AUGUST, 1897. Vol. X.

SUB-OCEANIC CHANGES.

By JOHN MILNE, F.R.S., F.G.S.

Introduction.

The object of the present paper is to draw attention to a certain class of geological changes which are in operation beneath the seas and oceans. The evidences we have of changes which take place on the land are as varied as they are numerous, but directly we reach a depth a few fathoms below low-water mark, we find ourselves on the boundary of an area represented by three-quarters of the surface of this planet, where it is usually supposed that geological changes are extremely slow. All the evidence we have relating to the abysmal level floors of oceans, where sediments accumulate with immeasurable slowness, and where ocean cables, unless destroyed in consequence of electrolytic action or faults in insulation, remain intact for twenty or more years, supports this view.

Directly we leave these level plains and approach submarine banks like those of Newfoundland, submarine ridges like that which runs down the central Atlantic, the steep slopes of the submarine plateaus which fringe continents and islands even though we may be in depths of 2000 and even 4000 fathoms of water, the evidences of great and sudden changes in the details at least of sub-oceanic contours grow more numerous day by day. It is in localities like these where cables are broken, not in consequence of defects inherent in themselves, but often directly in consequence of their burial beneath masses of materials which have apparently slid down from neighbouring banks. On the inner borders of continental plateaus, which are the submerged portion of the continental domes, detritus accumulates by marine erosion, whilst near to the mouths of rivers sediments which have been derived

* Paper read at the Royal Geographical Society, June 18, 1897.

from catchment basins of great area are deposited to form banks and ridges. These materials from continental areas are accumulated on areas which are comparatively small, so that the rate per superficial unit at which the land is being lowered is probably very much less than the rate at which it is being raised beneath the sea. This mechanical concentration of *débris* leads to the formation of banks which, on their outer faces, as will be shown later, are subject to sudden yieldings.

The causes of sub-oceanic yieldings in rocks and sediments are, broadly speaking, twofold. First, there are bradyseismical actions represented by secular folding, thrust, or crush. Sudden accelerations in these movements constitute earthquakes, which may be accompanied by the formation of a line of faults and landslips. Secondly, we look to sedimentation and erosion and the consequent creation of unstable contours, which may be destroyed by seismic action, facial sliding, basal crush by overloading, or the action of submarine springs and ocean currents. If we regard landslips on the land as the final result of certain geological processes which have created instability, then those which occur beneath the sea may be taken as evidence of somewhat similar activities. In many, if not in the majority of instances, submarine dislocation is a sliding effect resulting from overloading, whilst on land critical conditions are reached by activities which are subterranean.

Submarine volcanic action, which no doubt is an important factor in altering sub-oceanic form, inasmuch as attention has often been directed to the same, will only be briefly mentioned.

The sub-oceanic phenomena to which it is desired to call special attention will be treated in the following order:—

1. *Bradyseismic Action.*
   Seismic and volcanic activity—its frequency, cause, and effects.
2. *Sedimentation and Erosion.*
   Submarine landslides.
   Overloading with facial sliding or basal crush.
   Submarine springs.
   Current effects.
   Changes in shallow water.
3. *Changes evidenced by Cable Interruptions.*
4. *Conclusions.*
   Importance of a seismic survey of the world.

For the facts relating to cable interruptions, although much has been drawn from the publications and notifications of "Le Bureau International des Administrations Télégraphiques," I am greatly indebted to my friend Mr. M. H. Gray, without whose assistance I should have been able to say but little; to Mr. F. le B. Bedwell, R.N.; to Mr. H. A. Saunders; and to other gentlemen and engineers connected with the laying of ocean cables.

Section I.

Sub-oceanic Bradyseismic Action.

The existence of oceanic islands formed of stratified materials and the more or less folded strata of the continents themselves testify to the fact that upward movements have taken place in ocean beds. Submerged forests and other phenomena indicate that local lines at least have been submerged. Again, when we consider sub-oceanic, continental, and insular plateaus, or the ridges and banks—as, for example, those which follow a north-south line of considerable elevation down the mid-Atlantic—in relation to the distribution, both past and present, of the fauna and flora of widely separated countries, we see that the hypotheses of a submerged Atlantis, Lemuria, Antarctica, and other lands, are not altogether without foundation. The fact that round the borders and upon the summit of hidden domes and tablelands there are at present displays of seismic and volcanic activity, leads to the belief that sub-oceanic bradyseismic action is yet in progress, and we therefore have movements taking place beneath the ocean similar to those which, during an historical period or even a lifetime, have been repeatedly observed on coast-lines.

Distribution of Seismic Activity.—Amongst the earlier attempts to produce a work showing the general distribution of seismic activity throughout the world is the copious catalogue of Jacomo Antonio Buoni, entitled 'Del Terræmoto Dialogo,' published in Modena in 1571. Two hundred years later, no doubt in consequence of the unusual seismic and volcanic activity which at that time was so pronounced throughout the world, a seismological renaissance was evoked, and catalogues and treatises on earthquakes became prominent features in current literature. Whilst this was taking place in the West, in the East, at least in Japan, 'Jishin Nendaiki,' or earthquake chronologies, were being published. Amongst the more important publications of this century are the voluminous catalogues of Alixis Perry, and the lists of Mallet, Fuchs, and Montessus di Ballore. Enormous as some of these lists appear, directly we compare them with those of the only country which for some years past has been thoroughly surveyed—I refer to Japan—their incompleteness is seen in the fact that they give an earthquake-frequency for the whole world less than that which we know to be true for the fractional portion of the same represented by the Japanese Empire. The history of the seismic survey of Japan and its character are as follows.

In 1880 the present writer, with the assistance of Mr. Toshiwo Nakano, communicated with officials and others in all the principal towns of Japan, asking them to furnish information as to the number of shocks they usually felt per year, and at the same time to give, as far as they were able, some account of the shocks which had occurred

during previous years. The replies were numerous, and one conclusion derived from the analysis of the records was that in Japan there were, on the average, three or four shocks per day, which was the frequency calculated by Prof. Heim for the whole globe (*Trans. Seis. Soc.*, vol. iv. p. 30). Encouraged by these results, in the following year—to determine the extent of country shaken by a given shock and its origin—bundles of postcards were sent to many towns and villages within a distance of about 100 miles from Tokio, with a request that every week one of them should be returned with a statement respecting earthquakes which had been felt. The result of these communications showed that nearly all the shocks came from the seaboard on the east or north-east, and that very few originated from the mountains on the west or south-west. The barricade of postcards was then extended to a point some 450 miles north of Tokio, and ten important stations were furnished with seismographs. As the result of observations extending over two years, it was definitely shown that the greater number of earthquakes originated on the seaboard or beneath the ocean, whilst the mountains and volcanic regions were singularly free from these disturbances.

The establishment of these, and other important results, in 1884 led the Imperial Government of Japan to establish observing-stations throughout the empire, or over an area of 140,000 square miles. In 1895 there were 968 of these stations, of which 39 had instruments.

The general results which have been obtained, bearing upon the subject-matter of this paper, from these various surveys are as follows.

Earthquakes the Origin of which are Submarine.—The earthquakes which have a submarine origin may be divided into three groups—

1. Those which have been felt and recorded on land, and which, therefore, may be assumed, in the generality of cases, to have originated on a coast-line or within a few hundred miles off in the ocean.

2. Those which have been recorded on shipboard out at sea, either as tremors or as severe movements. Many of these disturbances are probably volcanic.

3. Those which have not been felt on land, but have been distinctly recorded there. In this group we find many of the earthquakes which shake the world.

As illustrative of the frequency of the first group, I will quote from observations made in Japan ("On 387 Earthquakes observed during Two Years in North Japan," by John Milne, *Trans. Seis. Soc.*, vol. vii. pt. ii.). Between 1881 and 1883 in North Japan the writer found that, out of 419 shocks, no less than 218 of them had originated beneath the ocean. There had been 137 which had originated on or near the seaboard, and therefore some of these had been of sub-oceanic origin, whilst only 64 had originated inland. A large number of these earthquakes came from the deep water off the mouth of the Tonegawa, the largest

river in Japan, which, as it approaches the sea, crosses the alluvial plain of Musashi.

Between 1885 and 1892 no less than 8331 earthquakes were recorded in Japan—that is, on the average during this period of eight years there were about one thousand shocks per year (*Trans. Seis. Soc.*, vol. xx.). A glance at the map showing the distribution of origins of these disturbances, shows that nearly all of them have originated along the eastern seaboard, and have been frequent near the alluvial plains. Between January, 1885, and December, 1888, when seismic activity was in a normal state—that is to say, when there were no long series of after-shocks—2018 earthquakes were recorded, of which at least 1034, or 50 per cent., originated beneath the sea. In Japan, therefore, along a coast-line of 1140 miles, there has recently been at least about 250 submarine shocks per year. In some years there have been 500.

From a seismic map of the world, I should estimate that round the Pacific there are at least ten sub-littoral districts where earthquake-frequency may be about half that of Japan. If this is accepted as probable, the sub-littoral seismic activity of the Pacific is represented by 2500 shocks per year, some of which have been accompanied by submarine landslips and consequent changes in the configuration of the ocean bed. When these latter are great, it is assumed that ocean-waves are created. If we consider the seismic activity round the coasts of the other oceans and seas which cover our globe as being, when taken together, equal to that of the Pacific, then for the world, out of a possible 10,000 shocks per year, 5000 of them have their origin on the sub-oceanic continental slopes.

To get information about the second group, or earthquakes which have originated far from land, we have to turn to the voluminous catalogues of Perry, Mallet, Kluge, di Ballore, Fuchs, and other statisticians. Such extracts have been made by Dr. Emil Rudolph in his papers, "Ueber Submarine Erdbeben und Eruptionen" (*Beiträge zur Geophysik*, Band i. and ii.), who gives us an account of 333 sub-oceanic earthquakes and eruptions. Because the greater number of these shocks are of volcanic origin, they will be more specifically referred to in the next section. The distribution of these is various, but here and there they herd together, indicating localities where changes are comparatively rapid. One favourite locality for submarine disturbances is in the Equatorial Atlantic, about 20° W. long., and again at 30° W. long., near to St. Paul's. For each of these regions Dr. Rudolph gives about thirty-seven shocks, in depths of water exceeding 1000 and 2000 fathoms.

The chief source of information for our last group is, however, derived from the records of horizontal pendulums. Taking a list of them published in the *Transactions of the Seismological Society*, vol. xx., by the late Dr. E. von Rebeur-Paschwitz, out of 301 records

obtained in twenty-seven months, there are only 25 which can with certainty be traced to their origin. Out of the 176 which remain, 105 were almost simultaneously recorded at places so widely separated as Potsdam, Wilhelmshaven, Strassburg, Nicolaiew and Tokio, and therefore cannot be disposed of as being due to some accidental disturbance of an instrument, or to small shocks of local origin. Each of them was a disturbance affecting a very large area, and indicates an initial impulse of great magnitude. What is true for the observations in Europe has also been true for my own observations in Japan, and also in the Isle of Wight, the only difference being, that in Europe the stations were from 300 to 600 miles apart, whilst in Japan and the Isle of Wight the stations were usually near to each other, and never more than 30 miles apart. In some instances, however, earthquakes of unknown origins were recorded in Japan and Europe, and it is fair to assume that in these instances the whole world had been shaken.

One disturbance noted by the author in Japan on June 3, 1893, had a duration of five and a half hours. It was also recorded in Birmingham, Strassburg, and Nicolaiew, at which latter place the duration of motion extended over eleven hours. Amongst unfelt earthquakes, both for magnitude and duration, it exceeded all that have yet been recorded.

Because the character of the unfelt movements, the origin of which cannot be traced, is identical with the character of those which have been traced to earthquakes originating at great distances, it is, for the present at least, assumed that the cause of the former is similar to the cause of the latter. If this is the case, the only place towards which we can turn to find the origin of the former appears to be beneath our oceans, and when they are of a magnitude approaching that of June 3, their origins must have been very far from land, otherwise a sensible shaking would have been observed upon the nearest shores.

If we take the three classes of records to which we have referred in conjunction, the conclusion to which they point is not simply that the submarine evidences of seismicity are more numerous than those on land, but also that they are very much more intense.

The Character of Submarine Seismic Districts.—If we compare together the characters of the districts where earthquakes of submarine origin are frequent with those where they are practically unknown, the differences are striking. In the former the land, as shown on the seaboard, usually consists of strata which are geologically new; it exhibits evidences of recent elevation, some of which can be traced to historical times, whilst its average slope from the mountains in the interior down beneath the ocean is, over a considerable distance, relatively very steep.* The unit of distance over which such slopes have been

* See note upon the "Geographical Distribution of Volcanoes," by J. Milne. *Geological Magazine*, April, 1880. Also "Address to the Geological Section," by Prof. C. Lapworth, LL.D., F.R.S., *Brit. Ass. Reports*, 1892.

measured is taken at 2°, or 120 geographical miles. The following are a few examples of such slopes :—

West Coast, South America, near Aconcagua ...	1 in 20·2	Seismic districts.
The Kurils from Urap	1 in 22·1	
Japan, west coast of Nippon	1 in 30·4	
Sandwich islands northwards	1 in 23·5	
Australia generally	1 in 91	Non-seismic districts.
Scotland from Ben Nevis	1 in 158	
South Norway	1 in 73	
South America, eastwards	1 in 243	

The conclusion derived from this is, that if we find slopes of considerable length extending downwards beneath the ocean steeper than 1 in 35, at such places submarine earthquakes, with their accompanying landslips, may be expected. On the summit of these slopes, whether they terminate in a plateau or as a range of mountains, volcanic action is frequent, whilst the earthquakes originate on the lower portions of the face and base of these declivities.

Seismic Strain, Deformation, Thrust, and Crush.—We assume that the contours referred to in the last section are mainly the result of rock-movement, and that seismic strain, due to a tendency to further adjustment, is greatest where earthquake origins are most frequent. The home of the volcano is evidently the place where the rocks have been most deformed, whilst that of the earthquake is at the base of steep sub-oceanic slopes where most deformation is in progress. The nature of the forces in operation producing this deformation are two-fold. First, there is the horizontal thrust, so strongly emphasized by Lapworth, which may or may not tend to increase the height of the mountain ranges bounding its line of action; and, secondly, a factor dependent on gravity, which, acting on the side of subaërial and marine denudations, tends to lower them. Earthquakes are for the most part spasmodic accelerations in processes with these characters.

The distortions observed in fossils and pebbles, the difference in thickness of contorted strata, and the "creep" in coal-mines, all indicate that great pressures may set up movements in stratified materials corresponding to a flow. Mr. William Barlow, in a paper on the "Horizontal Movements in Rocks" (*Quart. Jour. of the Geol. Soc.*, November, 1888), as evidence of this, calls attention to the contortions and foldings observed in glacial drift produced by a load above, the dip seen on the face of the Grand Cañon of Colorado, and the slight elevation observed in the area surrounded by cliffs known as the "San Rafael Swell." These and other appearances may be regarded as instances of "creep" upon a large scale, when materials have been squeezed out from beneath superincumbent strata.

In studying bradyseismical movement, we usually take cognizance of that which is most apparent. This is the vertical component of a

displacement, whilst the horizontal movement may be entirely overlooked. The geotectonic structure of many countries, however, shows us that displacements by horizontal thrust have taken place on an enormous scale, and it is not unlikely that these forces, accelerated by the effects of crush, are yet in operation round the basal contours of continental areas. Sub-oceanic earthquakes are therefore announcements that sub-oceanic bradyseismic action is in progress, and because these disturbances are more numerous round the submerged frontiers of continental domes and in mid-ocean than they are on land, it may be concluded that the distortions and displacements due to bending, thrust, and crush are greater beneath the sea than they are upon continents and islands.

Earthquakes and Landslides.—In addition to these bradyseismical effects, which only produce appreciable changes in sub-oceanic contour after the lapse of long intervals of time, there are the effects which accompany the actual shaking, which we may assume are not far different from those effects which we see produced by earthquakes originating on land. Many earthquakes which we feel, although they may create alarm and shatter chimneys, do not produce any effect upon rocks and cliffs. This, however, does not preclude the idea that shakings of equal intensity would not produce effects upon submarine slopes, where, as compared with similar slopes on land, critical conditions may more nearly approach in character to the mechanism of the hair trigger. Severe earthquakes on land are almost always accompanied by great landslides, and mountains which may for ages have been green with forest growth by the sliding away of materials on their sides, suddenly present the appearance of having been whitewashed. The probable effect of similar shakings originating beneath the ocean in the vicinity of steep slopes needs no explanation.

Another effect which sometimes accompanies these disturbances, and which may have been their cause, is the creation of a fault 50 or 150 miles in length, by which the country on one side of this, relatively to that on the other, has been suddenly raised or lowered 20 to 30 feet. Earthquakes of this nature, if of submarine origin, would naturally produce similar effects over large areas, and, if the magnitude of the displaced materials, whether by landslides or faulting, were large, as compared with the depth of the superincumbent waters, would also give rise to sea-waves.

One of the most recent examples of effects of this description was that which occurred on June 15, 1896, off the north-east coast of Japan. On the evening of that day a submarine earthquake occurred in this locality which was recorded in the Isle of Wight, and, from the magnitude of the diagrams, it may be assumed that the world was shaken from pole to pole. Following this shaking, great sea-waves spread over the North Pacific ocean. The explanation of this phenomena is that

the earthquake was produced by fracture of the rocks, not at a point, but over a considerable length, which movement, being accompanied by the displacement of huge masses of material, gave rise to the sea-waves. The sub-oceanic contour of this locality, where the depth of the water increases at the rate of 1000 fathoms in 25 miles until the 4000-fathom line of the Tuscarora Deep is reached, lends itself to this supposition. The only difficulty we experience is to estimate the volume of the material which must have been more or less suddenly displaced at these great depths to have produced so great a disturbance on the surface of the ocean. It is not likely that it was less than that of the greatest landslide of which we have historical record as having occurred upon the surface of the Earth.

The data we have for calculating the position of the origin of these great disturbances are numerous and exact. Our knowledge of the dissipation of earthquake energy, as represented by its destructivity as it radiates, indicates that an earthquake which dislodged sufficient material to disturb the whole of the North Pacific ocean must, at the very least, have originated 100 miles away from Miyako, on the north-east coast of Nippon, at which places a few houses were shattered.

If the mean depth of the water along the wave-path be h, and T be the interval of time between the arrival of the sea-wave and the vibratory wave, as pointed out by Hopkins, the distance of the origin from the point where the latter observations were made, may be approximately expressed as

$$= \sqrt{gh} \,.\, \mathrm{T}$$

From charts the value for h is about 2000 fathoms, whilst T, as deduced from accurate records of seismographs and tide-gauges, is at least twenty-one minutes.

Introducing these values into the above equation, the distance of the origin from the land is 130 geographical miles. Again, if V_1 be the velocity of the vibratory wave, which near to an origin we know to be about 7000 feet per second, and V_2 be the velocity of the sea, which we know from measurements on previous waves approaching this coast to be about 600 feet per second, then the distance of the origin of the coast may be expressed as

$$= \mathrm{T} \frac{v_1 v_2}{v_1 - v_2}$$

Introducing the given values for T, v_1, and v_2, the required distance becomes about 140 geographical miles.

This last calculation, strangely enough, brings us exactly to the base of the western boundary of the Tuscarora Deep, above which there is 4000 fathoms of water. This is a place from which many earthquakes have originated, affording evidences, particularly in this

instance, of sudden sub-oceanic changes along the basal frontier of a continent, the magnitude of which it is difficult to estimate.

Submarine Volcanic Action.—If highly heated rocks saturated with water were the only condition necessary for a display of volcanic action, such activities might be as marked in ocean basins as round their margins. The geological distribution of volcanoes, however, shows that before a volcanic magma can expand and find exit on the surface, the pressure due to superincumbent strata must be relieved, which is apparently obtained when they are sufficiently crumpled upwards to form mountain ridges. If, therefore, we seek for volcanic action beneath the sea, we may expect to find the same along submarine ridges, and if we discover the same, as we do along the central ridge of the Atlantic, the conclusion is that along such a ridge an upward brady-seismical movement is in progress, and not far from the region of eruptions there should be a region of earthquakes.

In certain instances, apparently, as is the case with the Aleutians and the Kurils, so many eruptions have taken place along a submarine ridge that a continuous and almost connected chain of islands has been formed. On the flanks of the most southern of the latter group recent marine strata have been raised, which, taken in conjunction with the fact that hardly a year passes without some new eruption being noted, whilst submarine shocks of earthquakes are frequent, indicates that Japan may in time become connected with Kamschatka.*

Any attempt to enumerate the various submarine ridges of volcanic activity at present evidenced by these outcrops would be beyond the scope of the present paper. One curious form of evidence, indicating the existence of volcanic activity entirely hidden in ocean depths, is referred to by Mr. W. G. Forster, in his paper on "Earthquake Origin" (*Trans. Seis. Soc.*, vol. xv. p. 73), from which we learn that cables have, after their interruptions, been recovered from which the gutta-percha had been melted—probably by water at a high temperature. The cables referred to are near the Lipari islands and between Java and Australia.

Some idea of the frequency of earthquakes and volcanic shocks originating in the ocean may be obtained from a paper by Dr. Emil Rudolph. From his descriptions, which are derived from the catalogues of Perrey, Mallet, the archives of the London Meteorological Office, etc., the following table has been drawn up:—

North Atlantic, 1724–1886	28	disturbances.
Azores, 1843–1884	20	,,
Cape Verde islands, 1854–1883	4	,,
St. Paul's, 1845–1886	22	,,

* See 'Notes on the Kuril Islands,' by Captain H. J. Snow, F.R.G.S., published by the Royal Geographical Society.

Equatorial Atlantic, 1747–1878	43	disturbances.
West Indies, Leeward islands, 1839–1886	17	,,
South Atlantic, 1616–1875	10	,,
West Mediterranean, 1724–1865	11	,,
East Mediterranean, 1820–1886	20	,,
Gulf of Mexico and Caribbean sea, 1751–1884	17	,,
Indian ocean, 1818–1883	28	,,
North Pacific, east side, 1790–1885	22	,,
South Pacific, east side, 1687–1885	47	,,
North Pacific, west side, 1773–1681	14	,,
South Pacific, west side, 1643–1885	10	,,
East Indian archipelago, 1796-1883	20	,,
Total	333	

The records generally are more frequent as we approach modern times, and, to some extent, for those seas and oceans where there have been the greatest number of observers. Dr. Rudolph regards all his records as referring to shocks of volcanic origin, and, if they agree with his definition of *Seebeben*, which are shakings originating in the ocean and propagated as elastic waves, we concur in his views.

Section II.

Sedimentation and Erosion.

In this section of the paper it is not the intention to emphasize work that has been already published respecting the accumulation and erosion of sediments at the mouths of rivers and along shore-lines, but to show that because submarine landslips are phenomena of frequent occurrence, the inference is, that not only on the margins of coasts, but also in the deep sea, there are causes in active operation which culminate in such sudden displacements. Landslips beneath the sea will, like those upon the land, occur upon the faces of steep slopes. One very important phenomenon leading to the production of the former, which differentiates, at least some of them, from the latter, is that there is beneath the sea a group of landslips which are probably due to the accumulation of sediments until a natural angle of slope is exceeded, when a facial sliding takes place. In other instances the yieldings may be the result of a basal crush, erosion by the escape of submarine springs or the action of unusual currents, and also, as we have already pointed out, to mechanical shaking produced by earthquakes.

Although many illustrations might be adduced, showing the existence of submarine cliffs which may suddenly yield under influences which cause yielding of sediments upon slopes, the sounding-lead, when dropped off the edge of submarine banks, the steeper faces of continental plateaus, the mouths of great rivers, and along sections of certain coasts, often reveals the existence of steep slopes over a distance of from one to several

miles. Illustrations of slopes varying between 1 in 1 or 45°, and 1 in 15 or 4°, will be given when speaking of districts where cables have suffered fracture. Average slopes of this nature, if we may draw any inference from what is seen on land, imply that the upper parts of such surfaces are inclined at a greater angle, and the lower parts at a lower angle, than that which is indicated by the average. The forms of stability for loose materials piled up on land are fairly well known, but the corresponding form for the same materials accumulated beneath water is not known. For example, the writer's investigations, renewed and carried on by George F. Becker (*Amer. Jour. Sci.*, xxx. 283), have shown that the form of a volcano like Fuji may be expressed by the equation—

$$\frac{y}{c} = \frac{e^{-\frac{x}{c}} - e^{\frac{x}{c}}}{2}$$

where $c = \frac{2k}{r}$

and y = radius of the figure;

x = distance of any horizontal plane from the base;

r = the specific gravity of the material;

k = coefficient of resistance to crushing.

This logarithmic curvature is seen to depend upon the density and resistance to crushing of the component materials, and it indicates that if we desired to increase the height of a mountain like Fuji, to resist the effect of the additional load, the area of its base would have to be increased. The mountain has reached a limiting form. In its upper portion it has a slope of 30°, but as we proceed downwards this rapidly decreases, so that at its base it is practically asymptotic to the plain from which it rises. Its average slope from base to summit is about 15°, or 1 in 4, and any cause tending to increase this would be followed by crushing or sliding. Such a mountain, if it were immersed in water, where the coefficient of friction between its component parts could be decreased, might, like Graham island, gradually subside to form a shoal or bank. The top of such a bank would be rounded, but the upper part of its sides we should expect to be steeper than the lower part.

To gain some idea of the angle of stability of short slopes of material like sand deposited beneath water, the following experiments were made:—

On the Deposition of Sand beneath Water.—Very fine dry sand was allowed to fall from a funnel on the bottom of a large but empty aquarium until it grew up as a heap against its side. By placing a piece of tracing paper on the glass, a tracing was taken of the contour of the mound thus formed. This was a cone, the sides of which had a slope of 35°. An equal volume of sand was added to the first cone,

which grew slightly in height, but its trace showed sides parallel to the one first formed. In a similar manner a third and fourth cone was formed, and the sides of these four cones, which are numbered 1, 2, 3, and 4, yet remained parallel (Fig. 1). After this a similar set of cones were formed in the aquarium whilst it was filled with water, the result of which was that cones 5, 6, 7, and 8, were formed, each of which, owing to the downward current produced by the falling sand, had at its apex a cup-shaped crater. In one case the inner slope of one of these craters reached 29°. The outer slopes of these cones at their summits did not exceed 30°, from which they sloped downwards at a continually decreasing angle to meet the plane from which they rose.

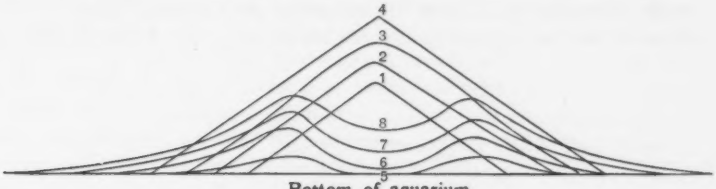


FIG. 1.

The average slope of these cones was 16°. The highest cone was only 6 inches, whilst the greatest base was about 1 foot 10 inches. The depth of water through which sand fell in a stream to build cones 2½ inches in height, was 9 inches. Because the forms of these heaps of sand beneath water were in great measure due to hydrodynamic action, to escape such effects the next experiments were as follows:—

A tin cone, 6½ inches in diameter and 2½ inches in height, was *packed* with dry sand and then inverted on a glass plate. When the cone was removed, the cone of sand with a sharp apex remained standing, although its sides had a slope of 38°. By very gentle tapping on the glass plate the sharp apex became rounded, and the slope of the sides quickly fell to 33°, after which the little mound was stable. The same mould was next packed with very wet sand, and after inversion on the glass plate, the whole was immersed in water and the cover *very gently* removed, and placed, still beneath the water, on one side. The apex quickly became rounded, and the upper part of the resulting form, as obtained by a tracing, became like Fig. 2, the diameter of the base increased from 6½ inches to $6\frac{7}{8}$ inches, whilst the lower portions of the two sides had slopes of 40° and 33°. This heap was very stable even when the water was agitated, and the glass plate on which it stood could be lifted without producing any marked change in form.

The last experiment was to allow fine dry sand to fall through water as a very fine stream from a nozzle about $\frac{1}{16}$ inch in diameter, and to

settle at the bottom of a tank. The falling stream had the appearance of a cloud of thin smoke, and after half a day a heap accumulated about 5 inches in height. The top of this heap was rounded, and its sides had slopes of 32° and 34°. The outward growth of this heap beneath its smoke-like cloud of falling sand was by intermittent facial sliding, and was very suggestive of what may happen on larger banks beneath the sea.

The same sand, but very dry, falling from the same funnel in air, also gave a cone with sides of 34°. When it fell from a funnel with a $\frac{3}{16}$-inch nozzle, this was reduced to 30° or 31°.

The information that can be deduced from these experiments is small. Because what is true for embankments and large heaps of sand upon the land is apparently true for heaps only a few inches in height,

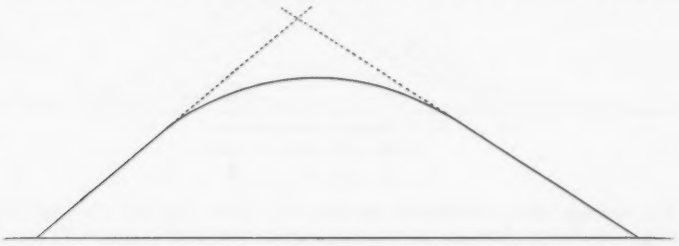


FIG. 2.—FORM OF UPPER PORTION OF A MOUND OF WET SAND BENEATH WATER.

we might therefore assume that small mounds of sand deposited beneath water would at least approximate in form to those of larger heaps deposited under fairly similar conditions. If this is admitted, we then arrive at the following conclusions:—

1. Sediments deposited under the influence of currents accumulate in slightly flatter forms than those of similar materials built up on land.

2. Peaks, edges, and corners of loose materials, which may be fairly stable on land, are beneath water, even when it is still, quite unstable and quickly become rounded.

3. A mound or bank, when thus rounded, is very stable even under the influence of strong currents, but the unstable form may be quickly reproduced by the accumulation of new sediments.

The only inference bearing on the subject-matter of the present paper is that, if by any means we know that sub-oceanic deposits are accumulating as slopes like those we see on land, the upper portions of the same are from time to time unstable, and facial sliding may be expected.

Landslips by Overloading and Facial Shear.—One form of submarine landslip which may be considered is that which may be found on the submerged faces of a delta. When a river enters an ocean because its channel is suddenly widened, and it comes in contact with the relatively

still water, its velocity is suddenly checked, and the bulk of its sediments are deposited to form a bar or submarine extension of a delta or a *levée*. In the latter case the line of the river channel is continued beneath the sea, and to the right and left of this submarine banks are formed. Such banks will have their steeper sides facing the channel, while as their boundaries grow upwards we know that in some instances they have assumed a gully-like form. When we compare the large catchment areas from which certain rivers derive their sediments with the comparatively small areas on which the bulk of these are deposited, it is not astonishing that these deposits have a rapid growth. Farther than this, because these accumulations are formed of loose materials collected together under the influence of gravity, and where we have currents, under the influence of hydrodynamic action, it seems reasonable to suppose that the resulting contours, as shown on the faces of banks, in many instances at least, represent forms which have reached a limit of stability. If, therefore, such *submarine* natural slopes have an existence, whether they are more or less stable than those of similar materials formed on land, it would seem that the banks they represent might from time to time be subject to sudden modification due to the sliding of masses of material on their faces, such slidings being produced by a facial shear by overloading or an increase in the angles of stability by the wearing action of currents. Spasmodic yieldings of this character would, for example, be most frequent when rivers were bringing down the largest quantities of sediment, or at times when currents on a coast alter in direction and intensity, and what is true for the yielding of a delta face would also be true for yieldings of materials accumulating on a submarine bank.

Yielding of Sedimentary Materials by Basal Crush.—Not only may banks yield by sliding on their faces, but when they are of great height it seems possible that the materials forming their lower portions may be caused to yield horizontally under the influence of the load which lies above them; in short, what has been assumed as true for rock masses under almost continental pressure is probably true for loose materials.

Example of approximations to these conditions are illustrated, as we have already pointed out, in the form of any volcano which has been built up by the accumulation of ash around a central orifice.

Submarine Springs.—Another cause tending to disturb, not simply the faces of delta formations, but the accumulations of loose materials covering the steeper slopes fringing the submarine plain which bounds most continents, is the not altogether hypothetical assumption of the existence of submarine springs, which in some instances at least are of marked magnitude.

Striking illustrations of underground streams are to be met with in many countries, whilst the existence of their equivalent may be inferred

from the copious flow of water from certain artesian bore-holes. One class of artesian bores to which attention may be directed are those in alluvial plains parallel and near to rivers. Examples of these exist at Itabashi near Tokio, in Osaka, apparently at Christchurch in New Zealand, and at other places. The phenomenon at the former of these places, where from shallow holes water gushes up copiously, seems best explained by the assumption that it comes from an ancient river-course roughly parallel with the adjacent river on the surface, and therefore deriving its head from the slope of an ancient valley of denudation, and not from the synclinal form of folded strata. Whatever may be the explanation of a stream practically beneath a stream, the fact remains that there are in the places cited, and possibly in very many others, very large bodies of subterranean water flowing seawards.

In Tokio, beyond the mouth of the Sumida, an indication of the escape of this or other subterranean streams may be inferred, because in the bay we find at least two fresh-water springs.

Another indication that enormous quantities of fresh water escape beneath the sea is found in the fact that, when we compare the rainfall in the catchment basin of a river with the quantity it discharges, after making due allowance for evaporation, the balance which remains and only to be accounted for by absorption is sometimes large.

From the experiments of Dr. Gilbert, F.R.S., which were for many years carried out at Rothamstead, St. Albans, with Sir James Laws, the percolation through loam with a subsoil of clay, both mixed with flints, although this does not bear a fixed relation to the rainfall, may be roughly taken at 50 per cent. of the same.

Robert L. Jack, F.G.S., in a report on "Artesian Water in the Western Interior of Queensland" (*Geological Survey Bulletin*, No. 1: Brisbane, 1893), attributes its existence in a large measure as being due to the absorbent properties of a certain series of sandstones, which he calls the bibulous Blythesdale braystones. From these beds, because they probably crop out beneath the sea, there is likely to be submarine leakage. As evidence of this Prof. David is quoted, who describes powerful springs at Port Macdonell, a little distance off shore. Again, Mr. G. S. Griffith says that "along the south coast of Australia, between Warrnambool and the Murray mouth, the sea literally bubbles up with fresh water." These artesian beds, Mr. E. F. Pittman says, probably extend beneath the Lower Eocene to the north-west part of Victoria and part of South Australia to the Coorong, where he believes fresh water escapes from the beach.

Whether the particular beds do or do not crop out beneath the sea, a striking fact connected with Australian rivers, as pointed out by Mr. H. C. Russell, F.R.S., is that, whilst the Darling only discharges 1¼ per cent. of the rainfall on its basin, the Murray discharges 25 per cent. The drainage area of these two rivers being under very similar climatic

conditions, the conclusion is that in the former basin a large quantity of water is continually disappearing underground by absorption.

Without attempting to multiply examples which show that fresh water from the land escapes beneath sea-level, from what we know about rainfall, its evaporation and absorption, and the geotectonic conditions governing the flow of underground waters, that much of this escapes beneath the sea on the fringes of plateaus surrounding continents and islands, is apparently a legitimate hypothesis. Granting this, then it would seem that deposits collecting around and above the submarine exits may from time to time be suddenly loosened and a landslip occur. At certain places where there is a seasonal variation in the escape of such waters, these occurrences would be periodical. Examples of submarine landslips, which are most frequent at particular seasons in deep water off the mouths of great rivers, will be given in the section relating to Cable Fractures.

Ocean Currents.—The last causes which may produce submarine dislocations to which we desire to draw attention are fluctuations in direction and intensity of ocean currents. It is difficult to say to what depths the effect of ocean currents are at various seasons perceptible, but many of them, like the *Kuro Siwo* of the Pacific, are vast bodies of water the fluctuations in the flow of which, as exhibited on the surface, are very great. The extent to which this latter body of water varies in the distance to which it may be perceptible between winter and summer, is roughly some 500 miles. Mr. Alan Owston, of Yokohama, a deep-sea yachtsman, tells me that a few days before the disaster of June 15, 1896, when North-Eastern Japan was inundated with sea-waves and some 27,000 lives were lost, there was strong evidence that this current had been pushed well in towards the coast. The schooner *Anaconda*, whilst proceeding southwards, had to work so close in shore that at night they anchored.

Professors Ijima and Mitsukuri, in Mr. Owston's yacht the *Golden Hind*, whilst dredging during the summer of 1896, could do but little deep-sea work in Sagami bay, owing to the unusual inset of the Kuro Siwo, which the Misaki fishermen on the adjoining coast say happens about once every six years. An indirect evidence of what seems to have been a fact was that the inset of the current killed the wind. As evidence of this, Mr. Owston tells me that he has often observed steamers passing out of Yokohama bay with their smoke, under the influence of a general breeze, blowing right ahead. Outside the bay, where they meet a 3-knot current, the wind has failed, and the smoke has been upright or left behind. Although a current may kill a wind possibly by influencing the atmosphere above it in a contrary direction, there is no doubt that wind piles up water and creates an unusual flow in its direction, to return more or less rapidly when the wind has ceased.

Assuming, then, that in these and other manners there are great seasonal and erratic changes in ocean currents, it does not seem improbable

that these may affect submarine banks, and possibly even cliffs, and disturb the isostasy of submerged materials along coasts. Examples where submarine subsidences have accompanied or followed heavy gales will be given in Section III.

Submarine Changes in Shallow Water.—Any attempt to give a detailed account of changes which take place in comparatively shallow water is somewhat outside the scope of this paper, but that such changes have an existence there seems to be little room for doubt. In the discussion of a paper on "Littoral Drift" by W. H. Wheeler, M.INST.C.E. (*Proc. Inst.* C.E., No. 2934, vol. cxxv.), we learn, on the authority of Rear-Admiral Wharton, F.R.S., that on the Yarmouth Roads where ten years ago there were deep channels there are now banks. The same is true for the Downs, whilst the Goodwin sands are different to what they were one hundred years ago, and all these changes have taken place beneath low-water mark. The late Sir John Coode, going down in a diving-dress, had seen the shingle on Chesil bank moving at a depth of 10 fathoms.

From the *Proceedings of the Institute of Engineers*, vol. xix. p. 670, we learn that chalk ballast thrown overboard 7 to 10 miles off shore in 10 fathoms of water has been brought ashore by gales in large quantity. Another evidence of movement of materials beneath low-water mark is the fact that particles of rock left by blasting have been brought up by moderate seas from depths of 30 feet. No doubt observations with these characters might be greatly multiplied, with the result of showing that the beds of certain shallow seas, by the slow movement of fine materials, are gradually changing in their contours.

What has been done in the preceding section is to show, as the result of direct observation, that submarine seismic and volcanic activities are strikingly great, the former even exceeding that which takes place on land. From this it is inferred that submarine bradyseismic action is great. The facts which have been given relating to sedimentation and erosion and consequent dislocation taking place beneath the sea are few in number, but it is pointed out that there are very strong reasons for supposing their existence. In the next section it will be shown that these reasons for the existence of dislocations are substantiated by many observations.

(*To be continued.*)

EXPLORATIONS IN THE COUNTRY WEST OF LAKE NYASA.*

By R. I. MONEY and Dr. S. KELLETT SMITH.

In the spring of 1895, an expedition left England for the purpose of examining and exploring certain territories of the British South Africa Company north of the Zambezi. Command was held by the late Dr.

* Map, p. 236. For country beyond the limits of map, see vol. v. p. 288 of the *Geographical Journal*.

J. A. Moloney, formerly of the Stairs expedition to Katangaland, and there accompanied him nine white men, including in their number a surveyor, a geologist, a surgeon, and prospectors. Disembarking at Chinde, on the East African coast, and proceeding up the now well-known Shire river route, the expedition landed at Bandawe, on the west shore of Lake Nyasa. Here preparations were at once commenced for the inland march.

The difficulties and troubles attending the formation of a large caravan are many, even under the happiest circumstances. At Bandawe they were increased tenfold, partly by the character of the natives, but chiefly by the fact that the lake-shore people in this district have been so raided and split up by the Ngoni in years past, that there remains no great chief from whom one can engage a necessary number of carriers. Calico failed to charm, for those willing to work refused the risks of the march, knowing that they are always welcome at the coffee plantations in the Shire highlands. The men who offered themselves would only engage as soldiers, so that ultimately we were obliged to send a small advance party into the interior for the purpose of seeking carriers on the Ngoni plateau. In the mean time, we busied ourselves with arrangement of loads and all necessary duties preparatory to a march. Not the least of these was the matter of drilling "askari." The average black of these parts is incapable of concentrating his attention upon any one thing for more than a few consecutive minutes; his train of continued thought is remarkable for its brevity; his memory concerning those things which the white man would have him remember is that of a little child; his faculties are hard tried before they can fully grasp the subtle difference between "right turn" and "left turn;" he has a firmly rooted idea that "medicine" is at the back of all good shooting, and trusts, in his preliminary stages, rather to the efficacy of an elephant hair plaited around the stock of his rifle than to his own great physical advantage of fine sight. On the other hand, he is imitative to a degree, and manipulates his rifle well as long as his instructor exemplifies the intricacies of drill before him. Though he knows not that it is a law, the great law of nature, "kill and be killed," thoroughly imbues him, consequently his "banduk" receives an amount of care and solicitude which betokens a conviction of its possibilities. Fighting and all that appertains thereto vitally interest him. He practises under the superintendence of a sharper-witted fellow-ranker until the impressions of words of command take on some permanence. Finally, he is a fatalist, and at his best makes a good soldier.

In a little time carriers began trooping down from the highland, not before we were anxious for them, for one always bears in mind the commencement of the rainy season. They were inexperienced, so the loads were limited as a rule to fifty pounds. This they could manage,

and the only things that really caused trouble were the Maxim guns and a collapsible boat.

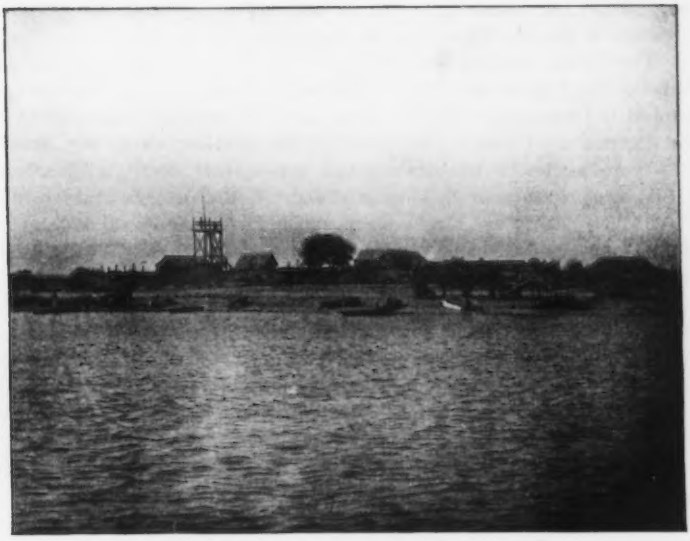
The country we were about to enter may be roughly described as a great plain, stretching away in continuity with the Tanganyika plateau in the north, falling with a gentle slope west and south to the Loangwa and Zambezi rivers respectively, and presenting towards Lake Nyasa a hilly escarpment, gradually declining with the southward grade of the land, so that opposite Bandawe the summit is 5670 feet above sea-level, while a degree south of this it is 4127 feet.

The road from Bandawe to Hora runs for some distance through the level lake fringe, passing many villages and intersecting great gardens of cassava. It then skirts the foot of the hills for a little distance before diving into them at right angles. Here commenced the stiff part of the march. The native path is always tortuous, and there was any amount of "collar work" as we breasted ascents, varying the seemingly eternal climb with a plunge across a valley now and then, the descent to which demanded "brakes hard down." So on for 30 miles of difficult country. Watercourses we passed in plenty, most of them dry. The Rivu, Kakewa, and Luweya rivers, entering Lake Nyasa, were welcome camping-grounds, the two latter being fine perennial streams, flowing through scenery as picturesque as one could desire. The hills are clad with forest practically untouched by hand of man, and for this reason, perhaps, owing to the want of thinning, the trees, except along the river-banks, do not grow to any great size. White quartz abounds. We were interested in the discovery of a rough earthenware pipe, in form like an agricultural drain-pipe, and of similar pattern to those which we afterwards came across, forming part of the native iron-smelting furnaces in the south. No other evidence of iron-working in this immediate neighbourhood was encountered. Perhaps still more interesting was the finding of a crucible and Marlin stone, similar to those occurring near ancient gold-workings in Mashonaland.

The latter part of this journey lay through a fine and pleasing park-like country. Copses and wooded slopes, good sweet grass, and rich surface soil might delude one into thinking one's self at home again. It looked a perfect game country, and doubtless had been so before the plague in 1892 and 1893 played havoc in the land. The first signs of habitation were met with in the shape of cultivated patches of mapera and ulopoko, carefully walled round with stout fences as a protection against wild animals. Later came scattered villages; and finally, after a passage along the valley of the Kasitu, the great populous plain of Hora, with its huge salient rock rising up some 1500 feet above the surrounding land. This plain may be taken as 4810 feet above sea-level, and therefore some 3290 feet above Nyasa. The climate is bracing, and free from the enervating winds which sap one's energy

on the lake. Years ago the Free Church of Scotland founded a mission station here, and the continued health of the present missionary, Mr. McCallum, his wife, and their little son, shows the suitability of the land for the white man. Cattle thrive well, as do goats and fat-tailed sheep; while millet, mapera, Indian corn, pumpkins, beans, peas, tomatoes, sweet potatoes and yams, ground nuts, and cassava yield good crops, even under the primitive methods of cultivation adopted by the natives.

At Hora one fact quickly became patent, viz. that here we had to deal with a people of very different stamp from those of the lake-shore. True their minds, like those of their lowland brethren, ran in narrow circles with curious and irrelevant tangents, and with an ever-present



FORT JOHNSTON.

personal centre; but their bearing had something in it of a free native dignity which attested the lordship of the land; they seemed conscious of race tradition and of a heritage of power. The best born of them were jealously observant of ceremonial and precedence in their palavers. Their emotions are probably limited; surprise and fear are certainly there, but the facial expression thereof is ever checked or determined by the diplomacy of the moment. Their feelings are under strong control; one is even reminded of the *nil admirari* stage of university studentdom, all which was a contrast to and relief from the chattering and childishly excitable natures of the lake shore. Twice only did we

see great chiefs outrage "form" by being taken off their guard. The first time was when a mad dog invaded our Hora camp, on which occasion M'zuka-zuka, of the blood royal, scrambled incontinently from the ground to the summit of a pile of provision cases at the first sound of alarm. Afterwards he descended more slowly, explained his haste by his knowledge of the consequences of a bite from such an animal, and finished by taking snuff with an extra curve of the wrist and tapering of fingers. The second time was at our little fort; of this anon.

The Ngoni, with whom we are now in touch, are the dominant power in the whole of that land between Lake Nyasa and the Loangwa river. Since the track of our expedition lay in this country, a *résumé* of their known history may be useful to the better understanding of their characteristics and customs. In this we must acknowledge great help from Dr. Elmslie's writings, and especially from the personal accounts of Mr. McCallum and Dr. Laws.

The Ngoni, it seems, were originally known as the Hlongwa, and inhabited the Tugela and Umpisi districts of Natal. Here they became subject to Chaka, who allowed them, however, to retain their own chief Zwangendaba. Chaka's rule, never of the gentlest, ultimately became so severe as to be unbearable, and consequently we find that the Hlongwa, probably in the second decade of the present century, fled from their country and struck north, under Zwangendaba, to seek a new home. At about the same time fled also Moselikatsi with his Matabele, and took a similar direction. Whether the two tribes met or not is a matter of doubt. Some maintain that they fought together for the good land which the Matabele now inhabit. Certainly a most tough battle took place years ago between natives south of Zambezi, and, to help the point, on one occasion when Jingujani, an old induna now with Mpeseni, visited us at the fort, we asked him of Moselikatsi. The old man looked surprised, and answered in some excitement—

"Moselikatsi! Speak not to me of Moselikatsi. He killed my people. To me Moselikatsi is dead."

All this in the Zulu tongue and perfectly intelligible to our Zulu interpreters. This would, of course, corroborate the struggle of the tribes; but it is just possible that Jingujani, who was afterwards reticent on the subject, may have had in mind some account of Moselikatsi's doings when under Chaka's rule. Be this as it may, the Hlongwa crossed the Zambezi under Zwangendaba, near where Zumbo now stands, on June 16, 1825. As they crossed "the sun died in the middle of the back of the heavens, and the day was finished." Such memories are permanent with the blacks; they tell them to their generations. The coincidence of the eclipse is certain, and our records, therefore, together with collateral circumstances, give us the date of their crossing. Up they came through the highlands west of Nyasa, plundering, killing, and slaving as they went, driving all before them, until they came to

the Fipa country south-east of Tanganyika. Here they settled for a time, and here Zwangendaba died.

The manner of his death is told by his people with all the simple and dramatic force of their speech.

"Zwangendaba lay sick in his hut. Around him were his sons and the indunas, and he rose up from where he lay and named Mtwaro, his son, chief after him. Then he said to them that he, Zwangendaba, had never seen the white man, but that they would, and when the white man came they were to be friendly to him. And then Zwangendaba became himself like the colour of a white man, and fell down, and his spirit went to the hilltops of the Fipa."

LAKE NYASA, FROM BANDAWE.

All which, being interpreted, means probably that Zwangendaba died syncopated, taking on the peculiar ashen-grey colour that such a condition produces in the light-toned black, and gave utterance to the peculiar prophecy of the white man's coming which has been spoken so many times in Africa by chiefs who have never themselves beheld a white man.

After Zwangendaba's death came internal dissension. Mtwaro was a weakling, and, conscious of it, resigned the power to his brother Mombera, who, strong even in his youth, could yet not control the other sons royal nor the more powerful of his father's indunas. Some of the people elected to continue the northward journey. All communication

between them and the parent stock is now cut off. In 1891 they were living to the south of Victoria Nyanza, and offered a temporary resistance to Lieutenant von Siegl, when that officer proceeded to occupy Taborah. Stairs, in his expedition to Katangaland, saw some of them at this latter place. They were called "Wangoni," and described as "bearing on their head busbies like those of our Foot Guards, but made of feathers instead of bearskin. Their arms consisted of three heavy spears and a shield of buffalo hide. . . ." A like spectacle to those we ourselves came across at Hora and in Mpeseni's country. The main body followed Mombera and his brothers southward to the land which they now occupy, and were subsequently joined by a moiety which had continued for a little time in the Fipa district under Mperembe. Thus was founded the Ngoni kingdom round about Hora.

A second period of disruption led to the migration of a large portion of the tribe towards the headwaters of the Tembwe, Sandile, Mkumbwa, and neighbouring tributaries of the Loangwa, where they are now firmly established under the rule of Mpeseni. At the same time a further number followed the headman Chiwere to the hill district south-west from Kotakota. Few, if any, of Zwangendaba's people are to be found elsewhere, although the followers of the late Chekuse, in the country south of Nyasa and west of the main waterway, took the same tribal name.

The change of name in the original tribe is to be noted. At first the Hlongwa, with the clan designation "Pakati," they now call themselves Ngoni, with the clan name "Jeri"—the latter taken from a tribe enslaved in the Fipa district, upon whom they impressed their own name of Pakati. The clan name "Jeri" is used at the present day by all those of Mombera's people who boast the blood royal. The Tumbuka and Nyanja people knew them also as Mazitu and Maviti, both names indicative of those roving, predatory habits which were only too palpable to their neighbours.

Such in brief is the early history of the Ngoni. The evidences of their Zulu origin are indisputable—their appearance and bearing; their traditions and superstitions; their speech, modified a little by contact with other tribes, and with some of the "clicks" gone, but still undoubtedly Zulu; their customs and habits of life; their prominence in warfare; their idea of building up a powerful tribe by bringing the people around into a state of domestic slavery, and training up as warriors the most promising of the young men.

Present politics at Hora are in a state of some uncertainty, owing to the lack of a paramount chief. Mtwaro died seven years ago from what was probably tuberculosis of the knee-joint. In consequence of his death, the few white men connected with the mission work in the country ran a peculiar risk, although at the time they knew it not. Witchcraft was suspected, and an ordeal by *muave* or *mtau* ordained.

This means the drinking of a decoction of bark containing active principles akin to those of strophanthus, and which results either in vomiting or death. People may be represented at an ordeal by animals, to whom the drug is administered in pellets; thus, at the trial in question, McCallum was present in the shape of a fowl, which had been begged from him as a gift, and other whites were there as dogs and goats. The results are probably largely under the control of the compounders of *muave*, who, by dosage or admixture with an emetic root,

NATIVE IRON-SMELTING FURNACE.

can regulate the action of the poison. The burden of Mtwaro's death was finally laid at the door of an inoffensive old native whose condemnation involved no further issues.

Mombera died in 1891 from apoplexy, leaving sons who were then mere children. Since that time affairs have been controlled by a council, at the head of which is Ngonomo, the chief of the late king's indunas. A fine old man he is, well over 6 feet in height, and erect despite his age. His life must indeed have been a strange and adventurous one.

A mere commoner, raising himself to the position of leader of Mombera's forces, and holding now the most influential position among a people jealous of their rights and respecting rank to the full, can only be a man of diplomacy and skill. His demeanour, his oratorical deliverances to those around him, which, not understood by those of us who had the luck to hear him, nevertheless impressed us by their sound and gesture; the evident deference paid to him, by even his superiors in blood, show all this. The time is now ripe, however, for the choosing of a new chief from Mombera's sons, and during our stay at Hora, a meeting, the third of its kind, was held for this purpose. The individual interests of Mombera's surviving brothers, who object to being ruled by a young nephew, combined with Ngonomo's grasp of power, rendered the whole thing a fiasco; and there are good grounds for believing that the latter used the fact of our presence as a powerful argument for the purpose of prolonging his regency. He refused to visit our camp while the main body was there, although he had been most friendly to our advance party and had entertained them at his kraal; and subsequently, when the main body had left, came in and hobnobbed with the rear-guard. We could never bring him further than a promise—a promise always evaded by an excuse. One day he was sick, another he had gone on a journey to worship at the grave of his fathers, and yet again he professed to have taken umbrage at one of his sons having been challenged by a sentry. Thus he went to the council with a free hand, excited his hearers by declaring that our presence meant war with which a young chief could not cope, and ended up by a dance at his kraal in which the spears were shaken in the direction of our camp. Possibly he was just as assiduous afterwards in cooling the heated blood.

Six months later, after the Mwasi attack, he showed some respect for the demands of the Administration by refusing sanctuary to the fugitive Chibisa; and, at the same time, messages in a friendly tone were transmitted through the Administration messengers by M'zuka-zuka and others of the Jeri.

It was our intention, upon leaving Hora, to throw out a wing from the expedition, which, travelling light, should proceed directly to the Loangwa, then cross that river and continue down its further bank to rejoin the main column towards the south of the plateau. Unfortunately, this effort proved abortive. In three days our men reached Kasembi's villages on the upper branches of the Rukuru, and that chieftainess assured them repeatedly that the next water towards the west at this particular season was distant a full five days' march. The look of the country, a long gentle rise away from the river to the horizon, was confirmatory of the report. Carriers firmly refused to proceed under any inducement whatever, and the project was therefore reluctantly abandoned.

The caravan now turned south, marching in three bodies by different

routes to Kasungu. Signal fires on hills by night showed that Ngonomo watched our exit from the country. One of us who retraced his steps after three days' journey, found all outlying villages closed, and met a small party of young warriors in all their panoply, who, however, were passive. Rumour had it that concerted action had been arranged between Ngonomo and the Kasungu chief; but the native tale as usual bore its huge discount, and we passed unmolested. Probably it was all a little act played to the gallery as the last scene in Ngonomo's artful drama.

Leaving the immediate plain of Hora, the country became broken—small hills with intersecting watercourses, with here and there great

CARAVAN ON THE MARCH.

rich-looking vleys. All the channels were now dry, the course of the wet-season streams, in many cases evidently of considerable volume, being represented by an occasional water-hole. This continued for two days, when we crossed the Mazimba river and passed Mosoro's. Then succeeded six days of thickly wooded country. Elephant spoor was here seen for the first time, a herd having crossed the path but a little while previously. The rate of march, forced by scarcity of possible camping-grounds, precluded much lateral search; but evidence of previous occupation existed in the shape of numerous disused iron-smelting furnaces, which all showed signs of hasty abandonment, charcoal and calcined ore being strewn about, together with cooking-pots and grass baskets.

The working of iron is certainly the most advanced art in this region of Africa. The ore is mined, smelted, and fashioned by the natives with great skill. Outside many of the villages stands the village smithy, merely a roof of shade boughs and grass supported by stakes. Here congregate the village gossips, who justify their presence by an occasional turn at the bellows. The tools are primitive, a rock for an anvil, a weighty stone for the sledge, and pieces of iron bound to wooden handles for the finer shaping and ornamental work. The bellows consist of two goatskins, each furnished with an open mouth like a purse, and connected up by a piece of bamboo pipe to a narrow clay union nozzle about 9 inches long. The blower sits on the ground, seizes the mouth of each skin in either hand, and raises and lowers them alternately, first with the mouth open and with a quick upward stroke to take in the air, then with the mouth closed and a tremulous downward pressure to force the blast. By this rude process, a hot charcoal fire is maintained, and the work turned out is excellent for the primitive implements used. Knives of great utility, and which take a good rough cutting edge; arrowheads and spears, many of them curiously barbed and twisted, and some showing a knowledge of the value of the "blood-groove;" axes for battle and for general purposes, ornamented with linear patterns and beaded edges, and with the blades set at an acute angle to the shaft so that every ounce of power is transmitted in the direction of the blow.

Kasungu derives its name from a hill, which rears its solitary head in the centre of a populous flat some 80 square miles in area. Its summit we found to be 4784 feet above sea-level, whilst our camp near its base was 3337 feet. The inhabitants of the district are a mixed race, chiefly Wachewa, and the chief Mwasi by no means commanded our admiration.

His position was certainly not an enviable one, his territory forming as it were a kind of buffer state between Mombera's Ngoni and those under Mpeseni in the south. To both of these he paid tribute, and further complications arose from the fact that he was swayed to a great extent by Arab influence. At the time of our arrival he was affording refuge to Saidi Mazungu, an Arab who some years ago was guilty of murderous treachery towards white men at Fort Maguire. The later development is told in the recount of the Nyasaland Administration during 1896, when it was found necessary to occupy his country and to punish him for his misdeeds. On this occasion he turned out an army computed at 18,000 men, not a surprising number when one considers the many villages then under his rule.

The Kasungu people defend their villages with a thick hedge of a species of euphorbia, or in some cases with a trench and earthwork. One such, Mangwasa's by name, was a perfect labyrinth of ant-clay walls. In the centre stood a high pole, on the top of which was perched

a very large and repulsive ape. This beast was evidently carefully fed and tended by the inhabitants—a strange thing, for these low-type savages are, as a rule, by no means attentive to the well-being of unproductive animals.

Many of Mwasi's people profess Mohammedanism, probably from contact with Jumbe's town and the Arab influence at Kotakota, on Lake Nyasa. Their religious principles, however, are crude and eminently elastic, stretching quite beyond the teachings of the great sanitarian, who seems to be credited here with more of vice than of virtue. A few symbols of Phallic worship, existing in hut decoration, were interesting; but, like the opposed triangles with their containing circle, or the

RIVER SCENE.

horseshoe on the stable door at home, they were "caviare to the general."

Comparing the Ngoni with the weaker tribes, such as the Wachewa or Wabisa, one could not help but notice their greater manliness. Had they any wish to conceal information, then they avoided the camp; had they objection to our presence, then they thought of driving us out by fighting. On the other hand, Mwasi, professedly unfriendly to and mistrusting the white man, visited us, begged cloth from us, and finally served up poisoned milk. Whatever of courage he and his people as a whole possessed was certainly of the negative type.

Emerging from the Kasungu plain and travelling west, no more natives are met with until Chenunda's kraal on the Rukusi. On the way thither the watershed is crossed at an elevation of 3800 feet above

sea-level, the rivers on the east being tributary to Lake Nyasa, those on the west flowing into the Loangwa and Zambezi rivers. Quartz and granite now disappear, giving way to shale and schist. The watershed is taken as the boundary between the British Central African Protectorate and the British South Africa Company's territory.

Chenunda is quite an insignificant chief. His few villages seem to be a kind of training-ground for the young bloods of Mpeseni's Ngoni. It was quite a common occurrence for a small band of them, perhaps no more than a dozen in number and on their own initiative, to rush a kraal at dawn, seize whatever took their fancy, assegai opposers, and clear off before the neighbours could collect to help, with their spoil of women and food. The poor inhabitants seem paralyzed for the time, and respond with a fitful fire from their few ancient flint-locks—a kind of warfare with minimum danger. Just before our arrival a raid had taken place. The Ngoni left behind one of their number prisoner, a boy whose father had taken him out "hunting." His captors dare not kill him, for well they knew the Ngoni revenge, and so they waited for a day or two until the raiders returned with their chief, and ransomed the lad with their own stolen goods. Such the "blooding" of the youngster!

Chenunda's people were on the verge of famine, all ill-fed, and many of them mere skeletons. This seemed to be the usual condition towards the latter end of the dry season. Not that the land was harsh, but because excessive planting and large crops simply excited the cupidity of the Ngoni. Thus their labour was limited to the growing of a simple necessity. They possessed no cattle; a few goats and fat-tailed sheep, with some fowls and pigeons, represented the extent of their live stock.

The country here is again attractive to the prospector. Quartz reefs abound, frequently iron-capped and invariably running north-east and south-west. Granite once more appears.

As the dry season was at this time well advanced, water became more scarce, and longer marches were necessary. The expedition now consisted of nine white men, one hundred "askari" (soldiers), and five hundred carriers. With such a large number the pace was of course slow, and we were obliged on one occasion to travel all night to reach the next camping-ground. On this march the degree of accuracy with which the native can space time was strikingly shown. The tripod of a Maxim gun had to be carried in one piece. This was a rather heavy load for one man, so two were told off to relieve one another at intervals of a sentry watch. They were left entirely to themselves. The first change was made at 2 a.m., with a cloudless, brilliant, starry sky, within one minute of the two hours; the second change at 4 a.m., with a bright moonlight, within five minutes; the third change at 6 a.m., with the sun's disc just appearing, within fifteen minutes. Doubtless,

knowledge of the position and movements of the stars enabled the above accuracy to be obtained, while the uncertain light of dawn possibly caused the greater error. The natives certainly recognize some of the constellations and give them names. A few of them were able to make diagrams on the ground of the relative positions of the component stars. Venus, in their language, they call "the wanderer of the night." The moon is to them all important, the "birth" of a new moon being quite an event, and the first view thereof the signal for a great chorus of salutation and rejoicing. The phases are recognized and accurately calculated. Some maintain that the earth is round, others that it is flat,

WALL OF KAMBWIRE'S KRAAL, FROM INSIDE.

but all are excellent in woodcraft and are rarely in error over a compass point.

The march from Chenunda's to our destination at Mafuta's was really hard. The heat was trying even to the blacks, who were forced to fashion rude sandals of goatskin to protect their feet from the scorching of the ground. Food was scarce, the spoils of the rifle became luxuries, for the pest, now in the south, had swept the country, destroying cattle, buck, and even elephants on its resistless progress from the north to the Zambezi. Water was our chief anxiety; the supply was very small, and that not above suspicion of things which thirst alone could disregard. Fortunately, the memory of privation is short, and

one can laugh now at the recollection of one member, the anniversary of whose natal day brought him a solitary meal of a cupful of Indian corn enriched by a bony, "smelly" catfish, caught by luck in a mud-hole.

Thirty miles down the Rukusi brought us to Kambwire's. This place is on what formerly was the main slave route from the Lake Bangweolo district of Central Africa to the coast *viâ* Lake Nyasa. The energetic action of the officials of the British Central Africa Administration has caused this to be abandoned, and whatever traffic may remain is now diverted chiefly into Portuguese territory. Matakenya, a Portuguese half-caste, who was the principal raider, has also lately died, and we may hope, therefore, that with the advent of the white man the last traces will disappear.

Approaching the villages, we were greeted by the sound of an enormous war-drum, made entirely of wood, carved and hollowed from a single trunk, and borne by two men on a shoulder pole. The chief himself, to whom advance messengers had been sent, attended to give us welcome (?). He sat with his headmen out on the plain, in the shadow of a great Mbawa tree. In this spot we eventually pitched our camp, and a most uncomfortable camp it was. The wind got up each morning about 9 a.m., a hot sickly wind with a choking dust which effectually dispersed whatever of energy the cool of dawn had given. Often it took the form of a whirlwind and then ensued a very nasty few minutes. Sand in clouds which prevented sight, a rush of askari, and the hanging on to guy-ropes and end poles; afterwards, the crawling out from collapsed tents, eyes, ears, mouth, and nostrils choked, with the hunting for scattered kit, and a mourn over the lost comforts of a smashed camp-bed.

Kambwire is a slight, rather aristocratic-looking personage, with delicate taper hands and small feet. He smoked his pipe with quite the grand air, and always had a retinue of body-servants to minister to his wants. Locomotion was performed on the shoulders of a sturdy slave, with a once gorgeous state umbrella between his majesty and the sun. The cares of government sat heavily on the old man. Mpeseni's Ngoni were a thorn in his side and necessitated perpetual vigilance.

A feud with his neighbour Chuaula, of the Sandile river, might at one time have been a relief, but just then Chuaula was having the best of it, *i.e.* he was five women captives and a few tusks of ivory to the good, and Kambwire therefore invoked our aid to patch up a peace. His kraal was surrounded by a mud wall some 12 to 15 feet high, loopholed and parapetted for attack; but the whole scheme of defence was deficient, inasmuch as the wall served not only as fortification, but also as the outer containing boundary of a ring of square huts whose roofs were of most inflammable grass. The inhabitants, chiefly Wabisa, were a mixed lot, due to slave-traders having left behind the sick and weak of their caravans. A peculiarity was the large number of men with only

one eye. It seems that the chief delighted to punish, and a favourite penalty was the boring of eyes with bamboo spikes or the heated blades of assagais.

Opportunity was taken to send a branch expedition down the Rukusi river to its junction with the Loangwa river. This latter, at the time of our visit, was low.

Some idea of the volume of water, and the difference between the dry weather and rainy season flow, may be gathered from the cross-section shown. When measured on November 8, a man could walk across, and the water was nowhere more than 18 inches in depth. The banks are 40 feet in height, and the country beyond them is flooded during the

CAMP AT LOANGWA RIVER.

rains. There is thus, taking the measured breadth of the river-bed, a volume of water of at least 44,000 square feet in sectional area, as against a trickling stream in the dry season. The adjacent land is level for some distance on either side of the river—on the east, covered with a low poor scrub; on the west, more densely wooded, but with open glades.

From Kambwire's we proceeded to Chuaula's, on the Sandile river. This road illustrated well the winding course of a native path. In the course of one day, for example, the column marched west, south, then north-east, and finally took its proper direction of south-west.

One camp *en route* was made at the Mchire or Salt river, a small

stream of the purest and brightest-looking water we saw in Africa. Its appearance was delusive; it contained in solution salts of high specific gravity, and although not entirely unpleasant to the taste, yet it tended to increase an already aggravating thirst. Bubbling up from springs in a sheltered coppice, it ran a short course, and then sank into a great hummocky "sponge," where travelling was dangerous, inasmuch as apparently sound turf formed but a thin crust over a slimy bog. The supply must be perennial. Game in great variety had congregated here for the sake of water.

Chuaula is an independent Wabisa chief, of much the same standing as Kambwire, and with subjects of a similar mixed type. He too is raided by Mpeseni's Ngoni and defends his villages by dense thickets and bamboo palisades. Only a small portion of land was under cultivation, just sufficient to supply the tribe with food. The same arguments against extensive planting hold here as at Chenunda's and Kambwire's. At Mwasi's alone, of all the places out of Ngoniland, was there any food to spare at the end of the dry season, and this for the reason that Mwasi's people were numerous enough to make resistance to raiding-parties, and that Mwasi had patched up a *modus vivendi* both with Ngonomo and Mpeseni.

The Sandile river was at this time quite dry, but water could be obtained by digging at a depth of 3 feet. Curiously enough, we found here a regular cloth industry. Cotton is grown, spun, and woven on a primitive loom into a strong and serviceable calico, which is worn either in its natural grey colour or dyed to a black. The knowledge of the art is probably the fruit of Arab intercourse. The people as a whole were very miserable and poor. Many of them showed mutilation, for Chuaula keeps a kind of execution grove where justice (?) is dispensed, and extremities lopped off for the slightest offence. Of the carriers recruited here, some had lost one hand and a few both. Our camp was visited by a professional dancer in this latter condition. It seems that, when dancing before Chuaula, one of his wives pressed forward and obstructed the chief's view. This was the offence, and the want of respect on the part of his family was visited upon him. The rude surgery of the battle-axe gave good results as far as the stumps went, but the loss of hands under the circumstances of life is simply an atrocious penalty.

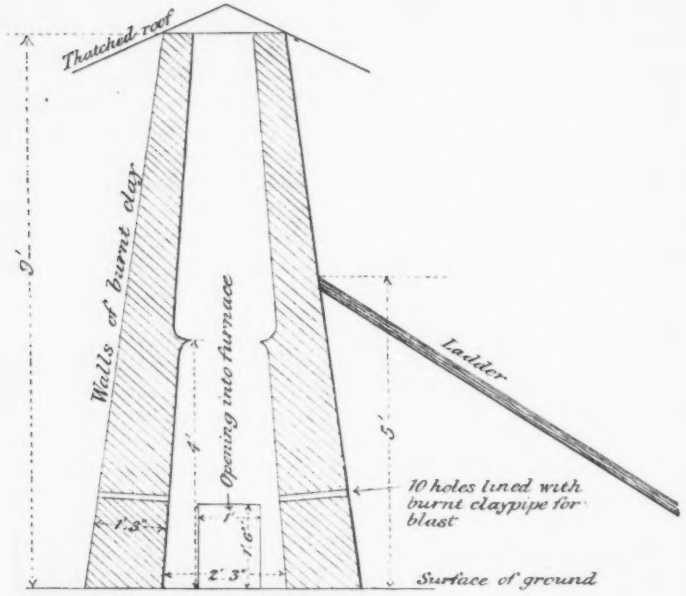
From Chuaula's, while the main column took its way into Mpeseni's country, a small party proceeded under Lieut. Biscoe to the south and west. Msoro on the Rupande, Bendwe on the Komongeri, and Momba on the Lusengazi were visited and their positions fixed. The inhabitants thereof were friendly and hospitable, although they had never seen the white man before.

The wet season was now commencing in earnest. The first rain came in the shape of a premonitory shower on October 6, after which the gathered clouds dispersed and we experienced intensely hot, dry

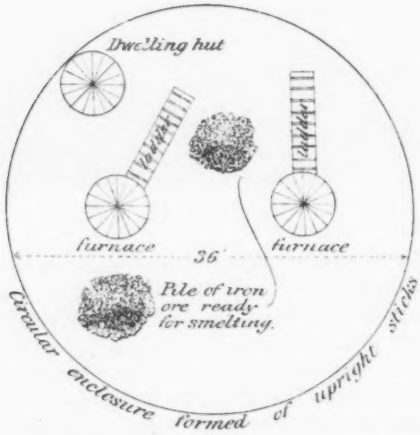
weather. Screen thermometers at the Kambwire camp gave a temperature of 108°. The majority of the clinical thermometers, graduated to 110°, were found broken by expansion of the mercury; they had been stored, however, in Congo cases which were painted in dark colours. On November 24 came a sudden and terrific thunderstorm, after which the rains were more and more regular until we looked for a downpour each afternoon, lasting as a rule from 2 p.m. until sundown. So on, with the exception of a fortnight's cessation in the middle of January, until the end of April, when lighter showers betokened the beginning of the dry weather. The rainfall in 1895–96 was particularly heavy, as shown by the excessive flooding of the Loangwa tributaries and also by the greater rise in Lake Nyasa and the Shire river.

LOANGWA RIVER.

Our approach to Mpeseni's country was made under better circumstances than we had anticipated. Mpeseni bears an evil reputation—perhaps deserved, and possibly exaggerated. Joseph Thomson, who visited him on his return from the Bangweolo Expedition in 1890, was fain to get away under cover of night. Mr. Sharpe, now acting commissioner of the British Central Africa Protectorate, also had an unsatisfactory time. Ground for alarm certainly existed in each case; it is very doubtful, however, whether Mpeseni himself at the time gave any aggressive orders or was guilty of any manifestation of bad will towards the whites. We received a more cordial reception. Advance messengers were despatched with a present of coloured prints, Arab



SECTION OF FURNACE

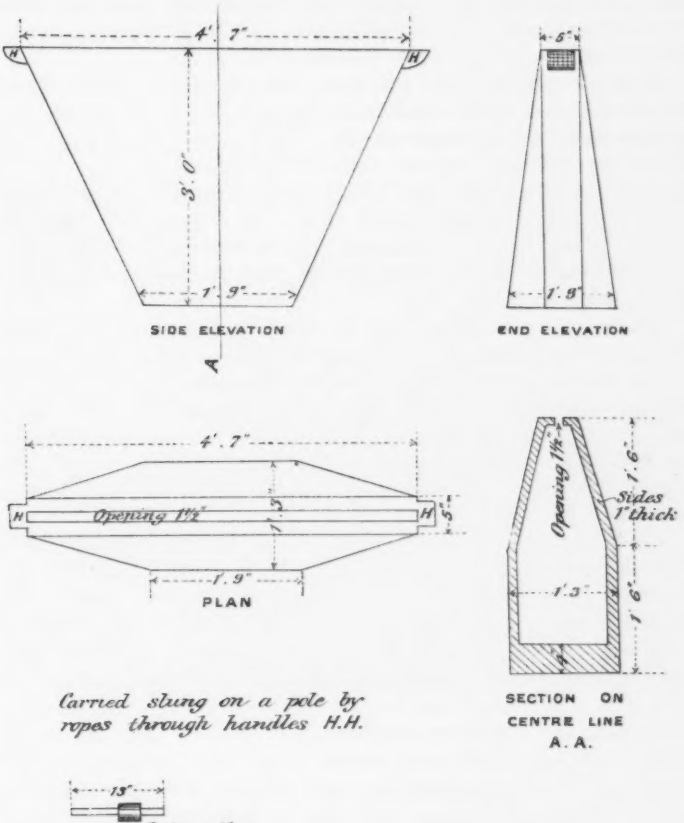


PLAN SHEWING ENCLOSURE WITH FURNACES.

NATIVE SMELTING FURNACE (DISUSED)

cloths, and other things dear to the savage heart; and in return Mpeseni sent out two sub-chiefs, who brought gifts of cattle and sheep and acted as guides on the way.

When the country of the Ngoni was entered, it was evident that we



KAMBWIRE'S DRUM.

were once again amongst an active and energetic people under a powerful chief, and where life and property were secure. We were reminded much of the condition of things at Hora: we had again the fertile plains, the hill ranges, the rushing rivers, and the high veldt beloved

of the Ngoni. Villages lay thick on the ground, free from the confining limits of a ditch or palisade, disdaining for the most part even the protection of a reed wind-break. The whole of the land, hillsides too, were cleared and prepared for the maize crops. Cattle, sheep, and goats were in plenty; but here, as elsewhere, the pest had left a mark not yet effaced. The inhabitants were most friendly, providing what ever additional carriers we needed and the chiefs escorting us from camp to camp.

Finally, on December 5, the expedition arrived at its destination—a small village of three kraals under the tributary chief Mafuta. The position was good in every way—lie of land, supply of running water, timber for building purposes, communication with the lake-shore by an easy and direct road, and, lastly, command of the gut leading between the hills into the breadth of Central Ngoniland. Rains and swollen rivers forbade further marching, so here we fixed our camp at an altitude of 3300 feet above sea-level and commenced the building of permanent quarters.

Whilst this was proceeding, Dr. Moloney, accompanied by Lieut. Biscoe, paid a formal visit to Mpeseni. They were received in the king's hut, and were the first white men to be so honoured. Even then Mpeseni could not, or would not, throw off superstition; he refused to look upon the white man's face, and sat with his back towards them during the short palaver. Nothing of importance transpired, and it was reserved for subsequent visitors from our party to learn more of the personality of this renowned chief.

On December 29, Dr. Moloney and two others of the expedition left Mafuta's for the lake-shore. Those remaining proceeded with the construction of the fort. A site was chosen crowning the summit of a gentle hill, and with due regard to watering facilities. The dwelling-house was our first care, the floor raised well above the general level of the enclosure; then followed askari's quarters, huts for the capitaos, grain store, a cook-house, and, later, a watch-tower with firing-platform, giving command over the country around. Three rip saws and a cross-cut, matchets, axes, spades, and a chisel or two, were our available tools; forest trees, bamboos, grass and ant-heap clay were the materials. No nails or screws; everything tied together with raw-hide strips and "njombo" bark.

The general plan of the fort was diamond-shaped, with a bastion at each acute angle for the lodgment of the Maxims. The defence consisted of an earthwork thrown up against piles, and measuring 10 feet from the bottom of the trench. The trench itself was 5 feet deep, with a level bottom 6 feet wide, and a sloping outer wall and parapet carrying the total breadth to 20 feet. Bush was cleared away where necessary to a distance of 400 yards, all tree-stumps being left projecting a foot or so above the ground.

A second visit was paid to Mpeseni at his own invitation. His manners were certainly not cordial, but on this occasion he unbent so far as to visit the white man's tent quite unattended and to hold a long conversation. He claims to be the eldest son of Zwangendaba, and so regards himself as *the* Ngoni chief. When asked if Mtwaro were not the first-born, he gave a typical reply, "As the cow to the calf, as the elephant to the cow, so was I, Mpeseni, to Mtwaro."

His appearance is not prepossessing. His facial type is low, and a corneal opacity in one eye combines with a shifty light in the other to accentuate the natural cunning and cruel look of his countenance. His power is very real; none of his people dare approach him without

LOANGWA RIVER.

bending the knee and giving the royal salute, "Bayete." His approach to council is signalled by a verbal trumpeter, who thunders forth his attributes and titles with all the quaint inferences and parallels of their language. He was more than astonished at the mention of the incident of the Zambezi eclipse.

"You," said he; "how did you know that?" and, indicating a height with his hand, "you must have been quite small then—so!"

Considering the date, we agreed that we were then very small, and Mpeseni became probably more convinced than ever that the white man was full of witchcraft. For a time all went smoothly. Various indunas were constant visitors, and brought for our use presents of milk, pombé,

pumpkins, Indian corn, sweet potatoes, fowls, fat-tailed sheep, and goats, so that we grew quite rich in native wealth and revelled in the unwonted luxury of our table.

By-and-by, however, things began to change. The chief men stopped their visits; the native boys employed around the camp as goat-herds, etc., went back to their homes; a vague uneasiness began to spread among our own soldiers, and all kinds of rumours were brought to our ears. Gradually it was manifest that Mpeseni had, for some reason, taken alarm, and the explanation came when we heard of the attacks upon Mlosi and Mwasi by the Administration. Mpeseni, in consequence, naturally thought that our presence was the prelude to his own destruction and began to collect his young men. Things were not improved by the fact that Chibisa, brother of Mwasi and fugitive from justice after the Kasungu fight, being rejected at Hora, had come for refuge to Mpeseni's country. He, of course, urged our destruction, and found a ready ally in Singu, Mpeseni's son and leader of his fighting men. Fortunately, Mpeseni is still in the prime of life and vetoed Singu's precipitate schemes.

Needless to recount the various "excursions and alarms." The tension continued, and reached its crisis upon the arrival of representatives of the British South Africa Company, who had come up to take over the fort and to administer the country therefrom. Their coming was a thing to be remembered. Four Atonga troops arrived early in the morning with the news that two white men, with some soldiers and a big gun, had crossed the Sandile river and were travelling fast towards us. About mid-day we heard the signal rifles go and lined up our own squad ready for the "salute." The path ran clear from the fort for some 300 yards, and then bent and disappeared behind a native village. At this bend stationed himself our "drum major." Suddenly, amidst the silence of expectation, he started his devilish tattoo, and a moment later round swung Warringham and Middleton, two great bronzed colonial giants, each well over 6 feet, and we saw strange white faces and welcomed our relief exactly a year to the day from the start of the expedition.

Two days later came a great "indaba." Mpeseni sent to the fort, as his representatives, the indunas Jingujani, Manota, Lisiao, Nyama, and Newkwa, together with sub-chiefs and their followers to the number of a hundred or so. They all squatted in and about the verandah of our house, Jingujani and Manota nearest the white men, for they, by virtue of age and rank, were to be the spokesmen of the party. A little shuffling and rearrangement of seats, the taking of much snuff, and then Jingujani began a long speech, the burden of which was that Mpeseni wished to be friendly with the white men, but was not afraid to meet him in war, if such were necessary. Manota followed in the same strain and was supported by the other indunas. Then came a judicious

reply from ourselves, which finished the formal part of the palaver; all hitherto conducted in proper style and etiquette and with the help of two interpreters, the first of whom translated from the Zulu to Chinyanja, and the second from the Chinyanja to Swahili. This for effect.

Now, Warringham and Middleton were perfect Zulu scholars, and when this part of the "indaba" was finished, they turned round, the one to Jingujani, and the other to Manota, and commenced a conversation in the purest Zulu. A look of astonishment gradually gave place to an expression of perfect amazement, and then succeeded great exclamations of surprise, followed by a rush and a violent shaking of hands. Know-

VILLAGE SCENE, KOTA-KOTA.

ledge of their own language quite conquered the old indunas, who at once lost all reserve and wound up the day with a feast from a slaughtered ox.

After this all was peace, and the time came, when the rains were finished, for our return to the coast. Leaving Mafuta's, we took a direct route through Mwasi's to the lake-shore. The path is easy the whole way, and it would be possible, with expenditure of a little engineering skill in dealing with a few of the gradients towards the eastern edge of the plateau, to transform it into a good practicable waggon-road. At Kasungu a fort had been built by the Administration, from which the surrounding country was controlled. Communication between this and Kotakota is constant, and extension thereof to Fort Jameson will open

up a great stretch of fertile land, perfectly suited for the most part for occupation by Europeans and rich in many things.

Arrived at Kotakota, we were received by Mr. A. J. Swann, the government representative, who extended to us the most welcome and kindly hospitality, and did all in his power to help our progress down the lake. The waterway was followed, as on our entrance into the country, with the necessary divergence into the Shire highlands and touching Blantyre for the purpose of avoiding the Murchison cataracts. Chinde was the point of embarkation. Before leaving, we visited the little cemetery, only too largely grown of late, and were gratified to find that the grave of Captain Stairs is now marked by a fitting tribute to his memory.

THE MAP.—The authors are indebted to the Rhodesia Concessions, Limited, for permission to make use of the map and notes collected while in their service, and to Lieut. Biscoe for the use of his photographs. The map was made from astronomical observations taken by R. I. Money and Lieut. Biscoe, the positions being determined on the spot from these observations, which were worked out by R. I. Money, and on his return to England, after having his instruments examined at Kew, the observations were corrected and worked out anew. Barometrical and boiling point thermometer heights were likewise worked out on the spot, and again on his return to England after receiving the corrections from Kew. The track surveys made with a prismatic compass were adjusted to the positions fixed by astronomical observations.

APPENDIX.

NOTES AS TO MEASUREMENT OF DISTANCES.

A mile was carefully measured along a level but loose sandy road at Fort Johnston. Traversing this several times in marching order gave, as a basis for calculating distances, 1920 paces and 18 minutes to the mile. To this number of paces the pedometers were adjusted. In the rough country between Bandawe and Hora, where there was a good deal of stiff climbing, the pedometers, worn attached to the waist-belt, proved quite unreliable, recording a much less distance than that actually traversed. On the route from Mafuta's to Kotakota, where the country offered few obstacles to an even rate of marching, the pedometer, when worn inside and attached to the top of a canvas gaiter, recorded from 18 to 40 per cent. in excess of a time measurement. It was found that the average rate of a column of porters with loads, taken for a whole day in cool weather, or from 6 a.m. to noon in hot weather, excluding stops, averaged 2¼ miles per hour. At the first start they set off at about 3 miles an hour, but by the end of the first half-hour they had generally settled down to a steady pace of 2¼ miles. For the purpose of plotting the track surveys, a time measurement of 2¼ miles per hour was adopted. This time measurement generally gave an excess of from 10 to 15 per cent. over the distance as fixed by astronomical observations, which was doubtless due to the winding nature of the native paths.

ASTRONOMICAL OBSERVATIONS.

	Latitude S.	Longitude E.	Remarks.
	° ′ ″	° ′ ″	
Hora	11 39 46	33 32 4	Longitude mean of three observations Latitude mean, three observations
Kasungu ...	13 1 23	33 12 20	Longitude mean of three observations Latitude mean, one observation
Chenunda's ...	13 9 58	32 28 27	Longitude mean of five observations Latitude mean, one observation
Kambwire's ...	12 51 50	32 10 15	Longitude mean of six observations Latitude mean, one observation
Chuaula's ...	13 8 48	31 54 57	Longitude mean of ten observations Latitude mean, one observation
Mafuta's ...	13 32 17	—	Latitude mean, two observations
Kotakota ...	12 54 36	34 16 27	Longitude mean of five observations Latitude mean, one observation

VARIATION OF THE COMPASS.

	° ′
Fort Johnston	13 53 W.
Bandawe	12 25 W.
Kasungu	9 38 W.
Kotakota	13 26 W.

HEIGHTS BY BOILING-POINT THERMOMETER.

Place.	Height above mean sea-level.	Remarks.
	Feet.	
Hora	4710	Mean of five observations
Kasungu	3325	„ two „
Kasungu hill (top)	4784	
Lungazi river	3140	
Diwa river	3355	
Chenunda's	2972	Mean of two observations
Kambwire's	1890	„ three „
Loangwa river (top of east bank)	1791	„ two „
Mchire river	1903	
Msansara river	1903	
Chuaula's	1899	
Chikua river	2147	
Chikwawa river	2945	
Uonze hill (at foot)	3287	
Dekasu's kraal	2911	
Kudugwa's kraal	3503	
Mafuta's...	3300	In Fort Jameson
Camp by Rukusi river	3438	
Camp 42	3696	
Camp 43	3652	
Kissongo river	3894	
Camp 46	3859	
Bua river	2372	
Kotakota (on shore at lake)	1508	Mean of three observations

TEMPERATURES.

Place.	Height above sea-level.	Month.	Shade.		Remarks.
			Maximum.	Minimum.	
	Feet.		°	°	
Chinde	—	June	72	61	In hotel room
On Shire river boat ...	—	July	81	59	In cabin of boat
Mandala	3300	„	87	66	In house
Matope	—	„	75	65	„
On upper Shire river ...	—	„	77	58	In cabin of boat
Fort Johnston	1450	„	91	58	In tent
Bandawe	1600	August	92	52	„
Hora	4710	„	80	54	„
„	—	September	88	51	„
Kasungu	3325	„	87	55	„
„	—	October	95	65	„
Chenunda's	2972	„	104	65	„
Chuaula's	1900	November	109	67	„
Mafuta's	3300	December	89	64	„
Kotakota	1580	January	93	70	In fort
Mandala...	3418	„	79	70	In house
„	—	February	76	68	„

RECENT AFRICAN LITERATURE.

By E. HEAWOOD, M.A.

THAT the age of great exploring journeys in Africa is well-nigh over, and its place taken by one of steady political development, is shown by a glance at the principal African books of the past few months, a large proportion of which deal with the extension or maintenance of European influence in one quarter or another of the continent.

Our list is, however, headed by the record of a journey * which, from the extent of little-known country traversed, seems to belong rather to the past than the present order of things. Dr. Donaldson Smith has much to tell of dangers and difficulties successfully overcome, whether arising from the determined opposition of Abyssinian soldiery, the fierce attacks of Galla tribes, or the necessity of journeying through trackless forests or waterless deserts. The book is written in a lively and piquant style, and—possibly from the author's readiness to look at the bright side of things, and his appreciation of the untrammelled life in the African wilds—we carry away from its perusal a far pleasanter picture of Central Africa than is supplied by many books of travel. He speaks in high terms of the beauty and healthiness of much of the country, and lays stress on its commercial and agricultural value. Sportsmen will find much to their taste in Dr. Smith's numerous rencontres with the large game of North-East Africa, with which his rifle played constant havoc.

* 'Through Unknown African Countries.' By A. Donaldson Smith, M.D., F.R.G.S. Illustrated. London: Arnold. 1897.

Unlike some recent writers, he puts much faith in the express rifle (the ·577), which he preferred to the eight-bore even against elephants and rhinoceros. The geographical results of the journey have already been so fully dealt with in our pages that it is needless to refer to them here. It may, however, be remarked that the difficulty Dr. Smith finds in supposing the Omo to make itself a way westward across the barrier of mountains seen to the north of Lake Abbaya does not exist if, as seems probable and is indicated in a recent map published in *Petermanns Mitteilungen*, the whole course of the river lies to the westward of the range.

Dr. Smith came in contact with many interesting tribes, from the powerful Boran Gallas to the Dume pygmies and the Adone negroes of the Jub. He shows a genuine liking for his Somali followers, and a quick apprehension of the various traits of character exhibited by the races met with. In a supplementary chapter he gives his views with regard to the present political situation in the countries he passed through, differing materially in his conclusions from other recent writers. He urges the necessity of curbing the arrogant pretensions of King Menelek to sovereignty in the countries south of Abyssinia, and holds that all civilized nations should concur in putting down the "brutal rule" of that sovereign. He considers that the Abyssinians would be unable to resist a well-organized force brought against them. The book is well illustrated, and contains, in appendices, reports by various scientists on the zoological and other collections made by the author. The maps are those already published in this *Journal*.

In Mr. Selous's latest book,* we have a narrative of the earlier stages of the Matabele insurrection by one who not only took a large part himself in the events recorded, but possessed ample opportunity of learning at first hand the details of occurrences at which he was not actually present. But the book is not a mere record of facts. It is useful as presenting the ideas of a shrewd observer on many questions affecting the future of South Africa, and although the author shows a keen sense of the injustice of the accusations which have been levelled against the white settlers, he is evidently actuated by an honest desire to show matters in their true light, and to point the way to a solution of existing problems in accordance with the best interests of the country and its inhabitants, both European and native. As regards the causes of the insurrection, Mr. Selous holds that, while the irksomeness of the labour regulations to a race indolent by nature, and the hardships arising from the rinderpest were important factors in the case, the Matabele were really surprised into revolt, in many cases against their better judgment, by a few leading spirits, who since the former war

* 'Sunshine and Storm in Rhodesia.' By Frederick Courteney Selous. London Rowland Ward. 1896.

had been awaiting an opportunity for revenge. He does not hesitate to avow his opinion that the removal of the white police was the event which made the rising possible, and thinks that with suitable precautions there should be no danger of its repetition. The country, he holds, is bound by the inexorable law of the survival of the fittest to be ruled by the white man, and the black man must either conform to his laws or succumb. The Dutch element is much larger than is generally supposed, and Mr. Selous points with satisfaction to the cordial relations maintained between them and the British during the revolt. The great desideratum in South Africa generally is the encouragement of goodwill between the two races.

Another chapter in the history of the gradual conquest of Africa by the white man is supplied by Captain Hinde,* well known as one of the lieutenants of Baron Dhanis in his successful campaign against the Arabs of the upper Congo in 1892–94. Dealing as it does with a region which may be truly described as one of the dark places of the Earth, it contains of necessity an abundance of harrowing details of bloodshed, cannibalism, and cruelty; but the importance of the events recorded as marking the final struggle for supremacy between European and Arab influence in Central Africa gives a special value to the detailed account of the campaign supplied by the author. Incidentally, much useful information is given with respect to the tribes of the Central Congo basin, one of the most interesting being perhaps that of the Waginia (Wenya or Wagenya of Stanley), the general ferrymen of the upper Congo, who, though spending their life on the water, are very bad swimmers, and do not even make their own canoes. Captain Hinde gives a vivid description of the oppressive stillness of the African forest, bearing out the statements of other observers as to the scarcity of animal life and the sombre tints of the vegetable world. The exploring work carried out by him on the upper Lualaba has already been fully described in the *Journal* (vol. v. pp. 420 *et seq.*).

Although likewise largely a record of fighting, Major Macdonald's book † is less concerned than either of the two last with the more revolting aspects of savage warfare, and, taken as a whole, presents a satisfactory picture of victories won in the cause of civilization in the extensive regions of British South Africa. The many-sided nature of Major Macdonald's work in the country, from his first arrival in 1891 to take charge of the railway survey, to his departure from Uganda in 1894 after the final pacification of that kingdom, makes him peculiarly fitted to write the history of the most momentous period in the

* 'The Fall of the Congo Arabs.' By Sidney Langford Hinde. London: Methuen 1897.

† 'Soldiering and Surveying in British East Africa.' By Major J. R. L. Macdonald, R.E. Maps and Illustrations. London: Arnold. 1897.

establishment of British influence in East Africa, and the completeness of his narrative is enhanced by the care he has taken to record the achievements of all who assisted in the work during the period in question. He gives a clear and unbiassed account of the unfortunate disturbances in Uganda previous to his arrival, based on his careful inquiries made under the direction of Sir Gerald Portal, and bears striking testimony to the great influence for good exercised by the missionaries in that country. He speaks generally in a hopeful vein with regard to the future of British East Africa, and is enthusiastic in his description of the Masai grazing-grounds, with their carpet of white clover, and fertile country waiting for inhabitants. The book contains several maps and some striking illustrations from the author's sketches and from photographs taken during the railway survey.

Under a somewhat misleading title,* Dr. Aurel Schultz describes a journey made over twelve years ago in company with Mr. A. Hammar, from Natal to the region of the Chobe and Okavanga rivers. The book forms a readable account of sport and adventure in South Africa, although the personal incident bears a somewhat large proportion to the geographical detail. It was, of course, only in the neighbourhood of the furthest point reached that any new country was traversed, but the information regarding the Chobe and Okavanga and the country between them is of value by reason of the meagre nature of the information supplied by other travellers to that region. The accounts of the vast herds of wild animals in the neighbourhood of the Chobe recall those of the pioneer travellers in South Africa early in the century. Between the Chobe and the Okavanga the country consisted mainly of dreary sand-belts, in which the travellers suffered from want of water. The latter river was struck at the town of Debabe or Indala—apparently the successor of the chief visited by Green—whose greed and treachery placed the party in some danger. Dr. Schultz speaks in glowing terms of the Okavanga and the country on its banks, and considers that the river is capable of becoming an important highway through the country. Geographically the most interesting point is the question of the bifurcation of the river. Dr. Schultz did not see the diverging-point of the supposed branch to the Chobe, but his conclusions, based on the discovery of an important stream entering the latter river from the west, were confirmed by the native accounts, while the general nature of the country renders such a bifurcation extremely probable. The book contains some good illustrations of scenery, and a map of the route by Bartholomew.

Before passing to works published abroad, mention must be made of the lately issued fourth volume of Mr. Lucas's well-known 'Historical

* 'The New Africa: A Journey up the Chobe and down the Okavanga Rivers.' By Aurel Schultz, M.D., and August Hammar, C.E. London: Heinemann. 1897.

Geography of the British Colonies,'* which relates to South and East Africa. It is divided into two parts, the first historical, the second geographical; and the great political changes which have taken place of late years in this part of the world renders the former particularly valuable. It is enough to say that the reputation for clearness and accuracy attained by the earlier volumes is fully sustained in the present issue.

Foreign works relating to Africa have been less numerous than usual during the past twelve months. Perhaps the most permanently valuable is Dr. K. Dove's account of the scientific results of his journey of 1892–93 in German South-West Africa, which has appeared as a supplementary number of *Petermanns Mitteilungen* (No. 120, 1896).† The journey was undertaken with a view to promoting the economic development of the colony, and particular attention was paid to the study of its climatic conditions as affecting the prospect of settlement by white men. The section devoted to climate is therefore by far the fullest, although many other points connected with the physical and economic geography of the country are also touched upon. Dr. Dove had to choose between securing a complete series of meteorological observations from a restricted area, or less detailed results from a larger extent of country, and, considering the objects in view, he wisely chose the latter, so that we now possess a good general idea of the climate of Southern Damaraland, in every way the most important part of the German territory. The observations also possess a special value from the care which Dr. Dove took to shelter the thermometers from the effects of the solar radiation, the want of which has often vitiated the results obtained by other observers. As in his previous writings, Dr. Dove lays stress on the healthiness of the country, and its suitability for cattle-rearing by settlers possessed of a certain amount of capital. The prospects of success in the working of minerals he regards as extremely doubtful.

Although relating to two of his earlier journeys in the Northern Sahara, M. Foureau's reprint of his official report, originally published in 1893, is to be welcomed on account of the very limited circulation which it then attained.‡ In addition to the traveller's journal, the report contains valuable records of meteorological and other observations, notes on the distribution of plants, etc., and is altogether a solid contribution to our knowledge of the desert regions south of Algeria. It

* Oxford: Clarendon Press. 1897.

† A popular account of the same journey was previously published by Dr. Dove as an independent work, with map and illustrations (Berlin: Allgemeiner Verein für Deutsche Litteratur. 1896). For a summary of the scientific results, see *Journal*, vol. iv. p. 271.

‡ Fernand Foureau, 'Au Sahara: Mes deux Missions de 1892 et 1893.' Paris: Challamel. 1897.

is to be wished that equally full reports of M. Foureau's later journeys may be published. The large-scale map which is added is a reproduction of M. Foureau's original itineraries, and does not contain the corrections introduced by his later journeys, but he hopes to publish in time a map which shall embody the whole of his observations.

Commandant Toutée's voyage of exploration on the middle Niger has been somewhat eclipsed by Lieut. Hourst's recent successful expedition, but the results were none the less valuable, and the account lately published * includes not only the incidents of the journey, but useful information on the peoples of the countries traversed, their manners and customs, industries, etc., as well as on the commercial possibilities of the Niger region. The author thinks highly of the use of the river as a highway to the French Sudan, pointing out that, whereas the journey from Timbuktu to Saint Louis occupies three months, his own return voyage from his farthest point up the river, three-fourths of the distance from the sea to Timbuktu, took only twenty-seven days, in spite of many hindrances. The region of the middle Niger is, he thinks, certainly worth the attention of Europeans in spite of the absence of mineral wealth and the small variety of articles of exchange yet available. It is only, however, powerful companies that will be able to make head against the initial difficulties of commercial enterprise. The map which illustrates the book is, unfortunately, on too small a scale to allow the detail to be clearly legible.

M. E. Foa publishes in separate books accounts of his big-game shooting, and of his travels, in 1891–93 in the Portuguese territory south-west of Lake Nyasa and north of the Zambesi.† This was then new and unknown country, and the existing maps, based on hearsay half-caste information of circ. 1820–1830, are widely wrong. M. Foa is an ardent and indefatigable hunter who has much to say on the habits of his game, and his first and larger work ‡ is extremely lively and interesting. The other book § contains a general account, well suited to French readers, of the various colonies between Cape Town and Lake Nyasa (all of which he touched or traversed), but its description of the new country north of the Zambezi is somewhat meagre, and the small-scale map adds nothing to our knowledge. Starting from Tete, M. Foa made his headquarters on Mount Chuüta, and then near Muchena, where a Portuguese garrison was massacred in 1888 by the chief of Makangaland. He visited Missale near the still undetermined charter-land frontier

* Commandant Toutée, 'Dahomé, Niger, Touareg. Récit de Voyage.' Paris: Colin. 1897.

† This notice of M. Foa's books is by Mr. J. T. Wills.

‡ 'Mes grandes chasses en Afrique Centrale.' Par Ed. Foà. Paris: Fermin Didot. 1897.

§ 'Du Cap au lac Nyassa.' Par Ed. Foà. Paris: Plon. 1897.

(at about 14° 15′ S., 33° E.), where gold-workings were opened and abandoned by some half-caste Tete traders sixty years ago. His previous trip to Undi, whose signature to mineral concessions was at that time in much request, nearly proved fatal. Four rivers cross the uninhabited plain, afterwards joining the Zambezi by one gorge. These were crossed by M. Foa dryshod and thirsty in October, but became impassable and 100 to 200 yards wide in November, so that famine stared him in the face, and he became, besides, embroiled in a native war. Finally, amidst unheard-of difficulties, he arrived at Chuüta after a seventy hours' fast.

A brief reference to one or two less strictly geographical works relating to Africa must suffice. Captain C. de la Jonquière supplies a useful sketch * of the history of the Italian connection with Eritrea, illustrated by maps. He treats the subject in a more dispassioned manner than is usual on the part of French writers on colonial questions, and thinks that Italy may still play an important part in the future of Abyssinia, if she is content to regard the substance rather than the name in her endeavours to make her influence felt. Captain E. de Vasconcellos, secretary of the Lisbon Geographical Society, has issued a succinct account † of the Portuguese colonies in their geographical, political, and economical aspects, the greater part of which naturally refers to Africa. It contains valuable details on the administration and resources of the colonies, based on reliable statistics. It may be noted that the trade of Angola is shown in a more favourable light than in Dr. Esser's paper, lately published by the Berlin Geographical Society.

As the first volume of an Italian scientific series, Giuseppe Sergi has published a detailed study ‡ of the Hamitic race in Africa, regarded from a purely anthropological point of view. From an examination of the physical characters of the people of North Africa, especially the form of the skull, on the persistence of which as a race-characteristic he lays much stress, he regards the Hamites as forming, with most of the peoples of South Europe and possibly the Semites, a definite species of mankind, which he names "Eurafrican." Two main branches, the eastern and northern, are to be distinguished in Africa, the dividing-line coinciding roughly with the western limit of the Nile basin. The former includes, among other subdivisions, the Nubians and those of the Nilotic tribes which, in the mixture of races, have acquired the Hamitic characters in the most marked degree. The book is abundantly illustrated with examples of the various groups. In

* 'Les Italiens en Erythrée.' Paris: Charles-Lavauzelle.

† 'As Colonias Portuguezas.' Lisbon: Companhia Nacional Editora. 1896.

‡ 'Biblioteca di Scienze Moderne,' No. 1. 'Africa: Antropologia della Stirpe Camitica.' Turin: Bocca. 1897.

conclusion, a study by J. Toutain of the Roman colonization in North Africa,* issued as a publication of the *Écoles Françaises d'Athènes et de Rome*, deserves mention. Two chapters deal with the geographical position and distribution of the cities, the rest of the work giving a full account of their architectural and other characters, and of the life of their inhabitants.

THE FIRST CROSSING OF SPITSBERGEN.†

THE first achievements of Sir Martin Conway as arctic explorer are fitly chronicled in the sumptuous volume recently published for him by Messrs. J. M. Dent & Co. Those members of the Society who were present at the meeting on January 25 last, when Sir Martin gave a condensed account of his adventures and exhibited some of his trophies in the shape of photographs and sketches, will be glad to read the narrative in detail, and to revel once more in the weird scenes of solitude and desolation so largely responsible for the prevailing epidemic of "arctic fever." Sir Martin Conway's work in the province he has so peculiarly made his own is sufficiently well known and appreciated to render it unnecessary for us here to describe how this particular example has been carried out; we need only wish him all speed with the volume on the history of Spitsbergen exploration promised in the introductory chapter, and proceed to chronicle briefly what he and his colleagues have done to add to that history.

The peculiarity of arctic exploration hitherto has been that it is almost wholly the work of navigators. Our knowledge of the topography of nearly all the arctic archipelagoes is limited to that usually required by the marine surveyor, who notes the outs and ins of the coast-line, takes the bearings of the chief mountain summits, and is content to sketch the geographical features generally from the immediate neighbourhood of the coast. Lord Dufferin was probably the first to point out that Spitsbergen is, as Sir Martin Conway puts it, "a land of mountains and glaciers, of splintered peaks and icy bays"—altogether beyond the sphere of the navigator, but eminently worth visiting for the scientific mountaineer. The object of this expedition was accordingly to cross Spitsbergen, and reveal the topographical and geological character of the interior.

The first landing was effected at Advent Bay, the party consisting of Sir Martin Conway, Dr. J. W. Gregory, Mr. E. S. Garwood, Mr. A. Trevor-Battye, Mr. H. E. Conway, and two Norwegian sailors. It was supposed that a series of bogs would first have to be crossed, and that these would be succeeded by an inland plateau on which sledges could

* 'Les Cités Romaines de la Tunisie.' Paris: Fontemoing, 1896.

† "The First Crossing of Spitsbergen." By Sir W. Martin Conway, M.A., F.S.A. J. M. Dent & Co. 1897.

be used; but things turned out far otherwise, the Nansen sledges taken were seldom available, and the want of Samoyede sledges added greatly to the difficulties of transport. It was found that the north and south parts of the island, except for a belt along the western shore of Wijde bay, were chiefly covered with immense accumulations of ice, while the central part was a region of boggy valleys and mountain ridges, with occasional more or less fertile slopes. As scientific interest centred in the latter, it was decided to depart from the original idea of crossing the island two or three times along widely separated lines, and to make a detailed study of a more restricted area. The expedition accordingly crossed from Advent bay to Klok bay, from Klok bay to Sassen bay, and from Sassen bay to Agardh bay on the east coast, and back to Advent bay.

The work done in the course of the traverses mentioned is summarized as follows: thirteen mountain ascents were made, including Mount Starashchin and Horn Sunds Tind; 600 square miles were surveyed in the heart of the island, and a rapid outline survey made on either side of Wijde Bay; the most complete reconnaisance of the coasts ever made was accomplished, the main island being almost circumnavigated; observations were made of the west, north, and south coasts of North-East Land; a landing was effected on the Seven islands, and Wiches Land closely approached. Some six hundred photographs were obtained, and scientific collections of great value, especially to the geologist, were brought home. The latter are deposited in the museums at South Kensington and at Kew, and are to be reported on later. The great scientific interest of Spitsbergen lies in the fact that it enjoys the most temperate of arctic climates, and its plateaux are accordingly undergoing erosion and denudation of the most vigorous kind, the process of cutting out valleys and mountain groups being exhibited in rare perfection. The promised scientific results must therefore be looked forward to as a great contribution to physical geography, and we shall then appreciate all the more this account of the difficulties and dangers encountered.

ON A REVISED MAP OF KAISER FRANZ JOSEF LAND, BASED ON OBERLIEUTENANT PAYER'S ORIGINAL SURVEY.*

By Professor RALPH COPELAND, Astronomer Royal for Scotland.

On the return of Dr. Nansen from his great journey across the arctic ocean, geographers learnt with surprise that the northern part of Lieutenant Payer's map of Franz Josef Land had proved of very little use to him on his journey southwards. This seemed to confirm the unfavourable opinion which had already been expressed by Mr. Jackson respecting the western part of the map, that persevering explorer having been unable to identify Payer's Richthofen peak, even when standing on the site of the mountain as laid down by the Austro-Hungarian expedition. This latter difficulty, however, admitted of a ready explanation: Richthofen peak had

* Map, p. 236.

been laid down by its discoverer from one point only, and from an estimated distance of about 60 miles. If, therefore, this distance had been over-estimated, the mountain would be not only misplaced on the map, but also exaggerated in height to a corresponding extent.

Nansen's case was altogether different; as is well known, he entered the region surveyed by Payer from the north-east, and found an open sea with a group of small islands where the Austrian explorer has placed a large glacier. Knowing Payer's great ability as a surveyor, from having been associated with him on the second German Arctic Expedition in 1869–70, I was painfully surprised at these extraordinary discrepancies.

On learning, however, that Payer had presented the original fair copy of his survey to the Royal Geographical Society, it occurred to me that I might possibly be able to trace the origin of the above-mentioned divergencies. My application to the Council of the Society for the loan of these valuable manuscripts was most courteously granted, and I was thus provided with the necessary materials for testing the accuracy of the Austro-Hungarian map.

It will be remembered how the *Tegetthoff*, imprisoned in the ice, was on August 30, 1873, carried within sight of the large group of hitherto unknown islands which its discoverers named Kaiser Franz Josef Land. For two months the floe carried the ship helplessly to and fro in the neighbourhood of the land, until it was finally frozen fast about 3 miles south of Wilczek island on October 31. During the two months' drift, bearings and sketches of the land were taken on eleven different days, beginning with the day of discovery. This section of the survey is recorded in twenty-seven lines on four sheets with Payer's usual painstaking skill; it is useful in confirming the general accuracy of the southern part of the map, as well as in locating Lütke and Orel islands, the eastern part of Salm island, and Cape Höfer.

The darkness of winter allowed only of flying visits to the shore, but on March 10, 1874, the task of exploration was begun in earnest by Payer. Within six days he occupied three of the most important stations of the survey—the summits of Capes Tegetthoff and Littrow, and the west tongue of Wilczek island, at the same time deciding on the general plan of operations. Lieutenant Weyprecht, the nautical commander of the expedition, undertook the measurement of a base-line on the ice starting from the ship, together with the connection of this base with two conspicuous points settled on by Payer. These points were: first, the summit of a symmetrical rock about 30 metres in diameter, situated on the low tongue of land just mentioned as forming the western extremity of Wilczek island; it is designated "VII." in Weyprecht's triangulation. The other point, "T," is the outermost but one, and the most regular in form, of a line of basaltic rocks running out from Cape Tegetthoff; it is well shown in the woodcut on p. 49, vol. ii., of Payer's 'New Lands within the Arctic Circle' (London, 1876). Both objects are visible for a great distance to the west and the north-east. Together with these points should be mentioned "V," a large cairn on the southern headland of Wilczek island, in which are deposited sundry documents, as well as a minimum thermometer. In the mean time Payer was to conduct a sledge-party to the highest attainable latitude, keeping up a running survey of the route traversed. This survey is depicted in about twenty panoramic views, with accompanying theodolite and compass readings made at as many different stations, ranging from Cape Brünn to Cape Brorok. These sketches were copied by Payer before the abandonment of the *Tegetthoff* in lines upon ten sheets of paper about 14 inches by 10 inches. If placed end to end, they would extend to a length of fully 65 feet. Interspersed with these sketches are a number of effective drawings,

which convey a vivid impression of the character of the scenery. Two of these are interesting as having been made when the temperature was nearly 56° Fahr. below zero. Altogether about 750 theodolite or compass readings are entered on these survey sheets.

A full account of Weyprecht's base and the adjoining triangulation is to be found in his "Astronomische und geodätische Bestimmungen der österreichisch-ungarischen Arctischen Expedition, 1872–74," published in the thirty-fifth volume of the 'Denkschriften' of the Imperial Academy of Sciences at Vienna, 1878. A recomputation of Weyprecht's measurements confirmed his deductions in all respects, and finally 18052·1 metres was adopted as the distance VII.—T, with an azimuth of 162° 40·9′ from the south, referred to the meridian of VII. Weyprecht's values are 18049·0 metres and N. 17° 19·1′ W., quantities agreeing almost exactly with the foregoing, taking into account the nature of the survey. The only discrepancy noted seems to be merely a slip of the pen affecting the two adjoining angles V.—VI. and VI.—A, measured at station IV., where 3° 43·5′ and 42° 39·0′ are to be substituted for 3° 1·5′ and 43° 21·0′. The uncertainty mentioned by Weyprecht respecting the important angle T—VII.—A (= 146° 27·5′) measured by Payer, is to a great extent removed by an examination of measures taken under favourable conditions on April 30, 1874, which give a value of 146° 28·75′. I have made use of Weyprecht's figures. All the angles of the triangles were not measured, nor was the levelling-instrument used in the determination of the angles always exactly centred. Under these circumstances Weyprecht did not attempt an adjustment of the triangulation. Owing to the roughness of the ice, a direct measurement of the base was altogether impracticable; the lengths of the various sections were therefore found by means of a levelling-staff and the micrometer of a "Stampfer level." According to investigations made by Prof. Stampfer, the accuracy of a base measured in this way is somewhat greater than if carefully measured with a chain. In summing up the length of the base, the distance from the northern end of the base, the mizzen-mast of the *Tegetthoff*, to the first pole on the ice has been inadvertently omitted from the result stated by Weyprecht in Vienna fathoms, but the length of the base is correctly given in metres. The results for the azimuth of the base afforded by two instruments, were afterwards found to differ to the extent of 9·5 minutes of arc. Weyprecht decided to adopt the figures obtained with the more reliable instrument. The difference is of no great moment for a provisional survey of the kind contemplated.

The latitude and longitude of the observatory on the ice near the ship were determined by Weyprecht and Midshipman Orel in the most satisfactory manner. The longitude referred to the northern end of the base is 58° 46′ 39″ E. from Greenwich. These figures, however, have still to be corrected for the error of the lunar tables, which, according to Newcomb,* made the moon's right ascension too large by about 9·0″ in the winter of 1873–4. The corresponding correction to the above longitude is *minus* 4′ 6″, hence the final longitude of the northern end of the base becomes 58° 42′ 33″ E. The latitude is 79° 50′ 56″ N.,† whence Weyprecht's

* 'Investigation of corrections to Hansen's Tables of the Moon,' p. 12. 4°. Washington: 1876.

† The provisional position given in 'New Lands,' and used in the published map, is 58° 56·0′ E., and 79° 51·1′ N.; the difference in longitude from the corrected final value is therefore 2·74 statute miles, by which distance Franz Josef Land has been hitherto placed too far east on the map.

reductions give the following corrected positions for the fundamental points of the survey:—

V.	79°	53′	28″	N. lat.	and	58°	40′	0″	E. long.	(Greenwich).
VII.	79	55	57	„	„	58	7	48	„	„
T.	80	5	12	„	„	57	51	3	„	„

By far the greater part of the survey was accomplished by Payer on the long sledge journey on which he and Orel succeeded in reaching Cape Fligely, 134 nautical miles north of the ship. In the accompanying map, nearly every station where Payer set up his theodolite or azimuth compass is marked with a small triangle. These points were sometimes on the tops of commanding elevations, but more usually they indicate the spot where a halt was made for the determination of the latitude at apparent noon, or for the measurement of azimuths. In the majority of cases it was necessary to determine these points by means of Pothenot's problem, with or without the help of the observed latitude. A number of the best determined unvisited points are distinguished by a small circle. In criticizing the survey, it must not be overlooked that Payer's primary object on the second sledge journey was the attainment of the highest possible latitude. He was therefore under the necessity of deviating as little as possible from a direct north and south track. Under these circumstances, it was only possible to give continuity to the survey, by repeated bearings of conspicuous points at a distance to the right and left of the line of march. It is obvious that the best results can only be obtained when such lateral points are observed from at least three stations.

Frequently the compass azimuths of objects were read off in addition to their direction as shown on the circle of the theodolite. In these cases the true bearings of all the observed points could be deduced with the aid of the accompanying table of the variation of the compass.

MAGNETIC DECLINATION IN FRANZ JOSEF LAND, 1874·2.

The *minus* sign indicates that the compass needle pointed east of true north.

Latitude.	Longitude—55° E.	56°.	57°.	58°.	59°.	60°.	61°.	62°.	63°.	64°.	65°.
	Declin.	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
85° N.	−10 20	−11 1	−11 43	−12 24	−13 5	−13 46	−14 27	−15 7	−15 47	−16 27	−17 7
	−86	−85	−82	−80	−78	−76	−73	−71	−69	−66	−63
84° N.	−11 46	−12 26	−13 5	−13 44	−14 23	−15 2	−15 40	−16 18	−16 56	−17 33	−18 10
	−80	−78	−77	−74	−73	−70	−67	−66	−63	−61	−57
83° N.	−13 6	−13 44	−14 22	−14 58	−15 36	−16 12	−16 47	−17 24	−17 59	−18 34	−19 7
	−73	−71	−69	−68	−65	−64	−62	−59	−56	−54	−53
82° N.	−14 19	−14 55	−15 31	−16 6	−16 41	−17 16	−17 49	−18 23	−18 55	−19 28	−20 0
	−67	−65	−63	−61	−59	−57	−55	−53	−50	−48	−48
81° N.	−15 26	−16 0	−16 34	−17 7	−17 40	−18 13	−18 44	−19 16	−19 45	−20 16	−20 48
	−61	−59	−57	−55	−53	−51	−50	−48	−46	−44	−43
80° N.	−16 27	−16 59	−17 31	−18 2	−18 33	−19 4	−19 34	−20 4	−20 31	−21 0	−21 31
	−54	−52	−51	−49	−47	−45	−43	−41	−42	−41	−38
79° N.	−17 21	−17 51	−18 22	−18 51	−19 21	−19 49	−20 17	−20 45	−21 13	−21 41	−22 9
	−48	−45	−43	−42	−41	−40	−39	−38	−37	−36	−34
78° N.	18 9	18 36	−19 5	−19 33	−20 1	−20 29	−20 56	−21 23	−21 50	−22 17	−22 43

This table was constructed by first computing the Gauss magnetic co-ordinates for the year 1829 for each 5° of latitude and longitude from Erman and Petersen's tables (*Astronomische Nachrichten*, No. 1900), and then filling in the intermediate values.* The difference (= −17° 51′) between the magnetic declination thus

* For the computation of this table, as well as for valuable assistance in drawing and lettering the map, I have to thank Dr. Halm of the Edinburgh Royal Observatory. —R.C.

obtained for the *Tegetthoff's* position and the mean declination found by Weyprecht and Brosch, added to each of the computed values, then gave the quantities in the above table. This process assumes, first, that Gauss's quantities give the correct declinations for 1829, plus or minus a constant, within the area dealt with; and, second, that the secular change in declination from 1829 to 1874·2 has been uniform throughout that area. The readings taken at the south-western extremity of Crown Prince Rudolf's Land may serve as an example of the use of this table.

STATION—CAPE BROROK, APRIL 11, 1874, NOON. LATITUDE BY OBSERVATION, 81° 40′ 14″ N. COMPASS DECLINATION BY TABLE = - 16° 41′.

Object.	Compass-reading.	Magnetic bearing.	Approximate bearing.	Theodolite reading.	Correction to theodolite-reading.	True bearing.
	°	° ′	° ′	° ′	° ′	° ′
Hohenlohe island, rock	S. 73° E.	= 287 0	303 41	148 20	+155 21	303 7
Hohenlohe island, west cape ...	S. 26½° E.	= 333 30	350 11	195 26	+154 45	350 13
Alexander Land, rocky cape 24 miles distant	S.W. (b. S.) ¾ S.*	= 25 19	42 0	247 44	+154 16	42 31
Mean correction to theodolite-readings					+154 47	

The theodolite readings for the remaining objects observed from this station, eight in number, increased by the quantity 154° 47′, give the following azimuths, which were employed, together with the three foregoing bearings, in the construction of this part of the map; at the same time, the greater estimated distances have been lessened by one-third:—

Object.	Theodolite reading.	True bearing.
	° ′	° ′
Hohenlohe island, summit	168 0	322 47
,, ,, cape (4 miles) ...	172 40	327 27
Alexander Land, low cape	227 20	22 7
,, ,, rocky cape (16 miles) ...	245 0	39 47
,, ,, (very distant cape) ...	— —	— —
Very high land (70 miles)	322 20	117 7
Low cape (1 mile)	339 0	133 47
Brow of cliff (quite near)	50 0	204 47
Low cape (near)	128 0	282 47

There are some parts of the map for which the materials of the original survey are no longer to be found, if indeed they still exist. These are—Petermann Land with Cape Vienna in the extreme north; the western shore of Crown Prince Rudolf Land, for which only the observed latitude of Cape Germania and the estimated

* There is an obvious error of a whole point, 11¼°, in this reading, which I have not hesitated to correct. Almost without exception, the only errors in the survey occur in such magnetic bearings as are given in *points*. It is much to be wished that this antiquated notation should be avoided in future surveys.

latitude of Cape Fligely are available, Orel's compass bearings having unfortunately been lost or mislaid. The data for the true situation of Lamont island are also wanting, but they probably are to be found amongst the papers of the late Lieut. Weyprecht, who can hardly have failed to determine its position with all necessary accuracy at the time of its unexpected discovery on the retreat from the ship. The bearings and details of the Hayes islands are also wanting. There was, therefore, no option but to copy these features from the published map. The outline of King Oscar land has also been copied, but in this instance the bearing of the central peak, already given, serves to define its azimuth with respect to Cape Brorok.

On the other hand, Payer's survey enabled me to locate two islands which now for the first time appear in the map. With Payer's permission, they are named after Brosch and Orel, the two officers of the *Tegetthoff* who so ably contributed to the scientific results of the expedition. Of these, Brosch island is a bold rock or cliff to the south of Kuhn island, near which the survey shows a third very small island still unnamed. Orel island lies to the south-east of the Klagenfurt group; it is nearly covered with snow, through which a few rocks show on the side towards the south. It is well located by favourable bearings taken in part on October 19, 1873, at a time when the *Tegetthoff* seems to have remained stationary for a whole day in the well-defined position shown on the map. There is also a small island, or rather rock, in the strait between Schönau and Koldewey islands, scarcely worth mentioning did it not repeatedly occur in the survey. It occupies the centre of the cut on p. 106, vol. ii., of 'New Lands,' in front of Schönau island, Cape Berghaus lying to the right in the distance. The high ground far to the east in Wilczek Land, also now indicated for the first time, was seen by Payer from his station three-fourths of the way up Cape Tirol at 10 a.m. on April 18, 1874, its estimated distance being 40 nautical miles. I have not succeeded in making out the situation of the westernmost of the Hochstetter islands, for which the single bearing from Cape Frankfurt is therefore shown by a dotted line on the map. Every name used by Payer in his work, 'Die österreichisch-ungarische Nordpol-Expedition in den Jahren 1872–1874' (Wien, 1876), has been retained, excepting Cape Buda Pest, Rawlinson sound, and Braun island, the existence of which seems very uncertain. It is also far from certain that the northern part of Wilczek Land, as now drawn, is not made up of several snow-covered islands.

Certain lines in the sketches made at 7 p.m. on April 7, and at noon on April 9 seem to have been drawn under the impression that the land to the west was continuous right up to Prince Rudolf Land. This impression appears to have been first dispelled on the ascent of Cape Schrötter on the evening of April 9, by the discovery of the sound leading to the west between Karl Alexander Land and Prince Rudolf Land. Unfortunately, the survey leaves the latitude of the southern boundary of his sound more than usually uncertain.

Payer measured the heights of a number of the mountains, partly with the aneroid barometer and partly with the theodolite. The aneroid-readings for three points only are entered on the survey sheets, while there are twelve points for which theodolite elevations are available. These latter seem never to have been worked out, except in the case of Richthofen peak, the details of their computation may therefore not be uninteresting. In conformity with the notation of the original map, the heights are stated in Vienna feet, of which 3·1635 go to a metre; to reduce to British feet, multiply by 1·0371. The heights have been computed by the well-known formula:

$$h - h' = d \cos (z - \tfrac{1}{2}d' + \rho) \operatorname{cosec} (z + \rho)$$

where h is the height of the observed object; h', that of the instrument at the observing-station, both above sea-level; d, the horizontal distance between the station

and the object in terms of the unit of height; d', the same distance in arc; z is the observed zenith distance, and ρ the terrestrial refraction. If d' is expressed in minutes of arc, and d in Vienna feet, then $d = 5886{\cdot}4d'$ in the latitude of the southern part of the map. The coefficient of refraction has been taken at 0·0894, as derived from the observations of the second German arctic expedition. To keep well within the mark, I have assumed the height of the instrument to have been 15 feet above sea-level at the ship and also at the station on or near an iceberg on May 3, 1874. Whenever the height of the theodolite above the surface enters into the computation, it has been taken equal to 5 feet. In the third and penultimate columns of the following tables, it will be noticed that the quantity sought is the height of the observing-station.

It may be well to add a few words respecting the trustworthiness of these results. The heights of Salm island, Cape Brünn, and the corner of Cape Tegetthoff, being derived from favourable angles of elevation, must be very nearly correct; with one exception, they are the only altitudes obtained directly from observations near the level of the sea. The altitude of Cape Littrow, being derived from that of Cape Brünn, is naturally somewhat less certain, and this uncertainty is increased in the deduction of the height of the summit of Cape Tegetthoff; but as this comes out 229 feet higher than the well-determined corner of that promontory—a difference which must be very near the truth, to judge from the various sketches which show both these features—it may be inferred that no great error has crept in. The Wüllerstorf mountains being fully 30 nautical miles from Cape Littrow, the angles of elevation of their summits are necessarily small, and correspondingly uncertain; the theodolite, however, was read in both positions for the higher summit, thus excluding any considerable error. Furthermore, we have the operation on the summit of Schönau island on April 22, making that station 1893 feet lower than the highest of the Wüllerstorf mountains, or 516 feet above the sea. This result does not differ excessively from Payer's estimate of 400 feet, considering the very roundabout way in which the computed altitude has been derived—the line of sight having traversed 80 miles of air.

I come now to the much-criticized Richthofen peak. This mountain was seen and sketched by Payer, not only from the summit of Cape Brünn, but also from an indeterminable point several miles further west, where he obtained a better view of Markham sound than was possible from his trigonometrical station on the cape just named. The elevation of the peak from the summit of Cape Brünn was determined in both positions of the instrument, the readings being 0° 22′ and 0° 30′, giving 0° 26′ as the elevation. To make sure that the readings corresponded to an angle of *elevation* and not of *depression*, Payer made two diagrams of the relative positions of the nonius and the zero point of the circle. Half the difference of these readings gives an index correction of 4′, in fair agreement with other determinations about that date. It is subtractive for the position in which Payer generally used the instrument. The distance, d', I have assumed so as to locate the mountain on an island of unknown extent, described by Jackson as "high rocky." Its altitude then comes out 4296 Vienna feet, as entered on the new map. If the peak is assumed to be on the fifty-fifth meridian, the height will be reduced to 3330 feet, while it can be no more than 2880 feet if it is but 20 nautical miles from Cape Brünn. But it is not at all likely to be so near, or Payer could hardly have estimated its distance to be 60 nautical miles, when the Wüllerstorf mountains were distinctly visible, in nearly the opposite direction, at a distance which we now know to be 40 miles, and of which Payer must have had a good general idea. From these considerations it seems very probable that Richthofen peak is to be looked for at no considerable distance from the point indicated on the map, and that its height does not differ greatly from 4000 feet.

COMPUTATION OF HEIGHTS ABOVE SEA-LEVEL FROM MEASURES WITH THE THEODOLITE.

Station ...	Ship.	Ship.	Cape Littrow.	Cape Littrow.	Cape Littrow.	Cape Littrow.	Cape Littrow.	Cape Littrow.	Iceberg.	Iceberg.	Schönau island.	Cape Brünn.
Date	Aug. 31, 1873.	Aug. 31, 1873	March 13, 1874.	March 13, 1874.	March 13, 1874.	March 13, 1874.	March 13, 1874.	March 13, 1874.	May 3, 1874.	May 3, 1874.	April 2?, 1874.	May 2, 1874.
Object ...	Salm island.	Hall island, south-west cliff.	Cape Brünn.	Cape Tegetthoff, summit.	Wüllerstorf mountains (2)	Wüllerstorf mountains (3)	Hill near Cape Oppolzer.	Cape Triest.	Cape Brünn	Cape Tegetthoff, corner.	Wüllerstorf mountains (3).	Richthofen peak.
h'	15·0 ft.	15·0 ft	[1623·5 ft.]	1279·4 ft.	1279·4 ft.	1279·4 ft.	1279·4 ft.	1279·4 ft.	15·0 ft.	15·0 ft.	[2409·0 ft.]	1628·5 ft.
d' (arc) ...	0° 19·60′	0° 37·40′	0° 10·65′	0° 5·10′	0° 30·45′	0° 30·60′	0° 15·52′	0° 23·95′	0° 12·70′	0° 4·55′	0° 26·15′	0° 37·60′
ρ	0° 1·75′	0° 3·34′	0° 0·95′	0° 0·46′	0° 2·72′	0° 2·74′	0° 1·39′	0° 2·14′	0° 1·14′	0° 0·41′	0° 2·34′	0° 3·36′
z	89° 32·00′	89° 54·00′	89° 45·50′	89° 37·50′	89° 53·00′	89° 51·00′	89° 54·50′	89° 59·50′	88° 51·25′	87° 21·50′	89° 28·50′	89° 34·00′
$h-h'$ ...	1209·9 ft.	1367·9 ft.	−314·1 ft. / −5·0 ft.	214·7 ft.	1016·7 ft.	1129·6 ft.	315·4 ft.	424·0 ft.	1608·5 ft.	1250·3 ft.	−1887·8 ft. / −5·0 ft.	2668·0 ft.
h (Vienna feet) ...	1225	1383	Cape Littrow, 1274	1494	2296	2409	1595	1703	1623	1265	516	4296

Aneroid-readings were taken apparently on three ascents only—those of Capes Tegetthoff, Littrow, and Brünn—and only on the last occasion was the temperature of the air recorded both at the summit and at the base of the elevation. The available materials, interpolated where necessary, are shown below, together with the resulting heights, h, computed by Rühlmann's tables.

COMPUTATION OF HEIGHTS FROM ANEROID-READINGS.

Date.	Aneroid-reading.		Temperature.		$h-h'$	Assumed.	h		Eminence.
	Upper.	Lower.	Upper.	Lower.		h'	By aneroid.	By theodolite.	
	mm.	mm.	C.	C.	feet.	feet.	feet.	feet.	
1874, Mar. 12	726·00	763·57	−31½°	−31½°	1128·1	15	1143	1494	C. Tegett., summit.
,, ,, 13	736·00	770·50	−43½°	−43½°	971·1	15	986	1274	C. Littrow.
,, May 2	717·65	765·20	−21½°	−12·31°	1520·5	15	1535	1623	C. Brünn.

It will be noticed that the heights are in every case much less than those obtained with the theodolite. The difference is most likely owing to the effect of the intense cold on the delicate mechanism of the instrument employed, for it is least in the case of Cape Brünn, which was ascended under more favourable conditions than the other summits, as far as mere temperature was concerned, although the wind made the ascent the most trying that Payer ever made. In the absence of any information respecting the temperature-coefficient of the particular aneroid used, it is obviously impossible to place any confidence in the heights obtained with it. The readings on March 13 prove, however, that the aneroid barometer still works at a temperature when the freezing of the quicksilver stops the action of the ordinary barometer. Future experiment must determine whether the indications of the aneroid at these low temperatures can be treated in such a way as to give the true pressure of the atmosphere.

The heights obtained with the theodolite have alone been entered on the map, from which I have omitted the heights given in the original, as these seem to have been merely estimated. It is by no means unlikely, however, that Schönau island is not so lofty as the computation makes it, but it seemed best to retain all the computed heights, as the actually measured differences of altitude cannot be far from the truth.

The accuracy of the survey is very different in different parts. In the south all the more prominent points are so thoroughly connected with each other and with the base by well-conditioned triangles, that errors so large as 200 metres are scarcely to be apprehended in the whole stretch from Cape Oppolzer to the Wüllerstorf mountains, Orel island, and the position of the ship on October 18 and 19, 1873. Fully as accurate are the stations on the ice on March 31, April 1, and May 3, as well as the station at the foot of Cape Frankfurt occupied on April 21. In this section the agreement between the new map and the original chart published by Payer is almost perfect in all essential particulars. In Austria sound considerable discrepancies between the two maps make themselves evident, probably the reason being that the Austrian cartographer who constructed the chart relied to a considerable extent on the estimated distances covered by the explorers on their marches, whereas I mainly based the reconstruction on the observed latitudes, adjusting these by the smallest possible quantities that served to bring them into practical agreement with the recorded azimuths. In this way, after repeated trials, I succeeded in obtaining a network of triangles embracing the various

stations on the ice as far as and including Cape Brorok. To judge by the agreement of the bearings, it does not seem that these stations can be in error to the extent of much more than a nautical mile either in latitude or longitude. Probably the same degree of accuracy will be found in the positions of the Stoliczka islands, of Kane island, Coburg island, Hohenlohe island, the eastern shore of Rainer island, and the eastern summit as well as the general outline of Becker island. On the other hand, Cape Tirol, having been passed in cloudy weather on the northward journey, and having been observed from Cape Brünn under unfavourable conditions as to the stability of the theodolite, may be several kilometers wrong in latitude, although its longitude is well defined by azimuths from the neighbourhood of Cape Frankfurt.

The following table shows the various observed latitudes,* together with the observations on which they are based, as well as the final adjusted latitudes used for the map. The greatest differences, M—O, between the map and observations occur on March 31 and April 1, for which the positions on the map are derived solely from that of the ship by means of the triangulation.

The greatest error in the original map is in the north-eastern part, where Payer shows the large Dove glacier extending far to the north, in place of the open sea with a solitary group of islands which Nansen found in that region. There seems little doubt that Payer on his northward journey mistook fog-banks on the eastern horizon—possibly in combination with the ice-hummocks, which would naturally be formed on the margin of the fiord ice—for an extension of Wilczek Land towards the north beyond the latitude of 81° 5′. This mistake is the more pardonable from the fact that Payer seems certainly to have obtained a glimpse of one of the islands just mentioned on the afternoon of April 7, 1874, which he named Freeden island, a name which has been very properly retained by Nansen. At 6.15 p.m., on the day in question, Payer made a halt on the ice, Cape Beuermann bearing west-south-west (true) at an estimated distance of half a nautical mile. At this point he noted that in exactly the opposite direction land was distinctly visible, which he described in these words: "The Ostland knoll 25–30 nautical miles distant—a cape, perhaps a north corner of an island jutting this way towards the west."† The atmospheric conditions were extremely favourable for seeing objects at a great distance. The day had been bright and clear, with a shade temperature of −16° R. at 8 a.m., rising to −13·1° R. at noon, as recorded on the survey sheet. The clearness of the air is attested by a black-bulb reading of +3·5° R. at 2.30 p.m. Under these circumstances, as the sunlight came more and more from the west the visibility of objects in the east would be increased and there would be every possibility of seeing land at the distance named.

The existence of Hoffmann island seems to be placed beyond doubt by two pairs of azimuths, observed at 8 a.m. and at noon, also on April 7, the island subtending angles of 23° 13′ and 26° 2′ respectively at the two stations. According to the sketches, it is completely covered with snow, and rises only slightly above the level of the sea. This may account for its not having been noticed by Nansen and Johannsen on their kayak voyage towards the west.

In the relative positions of the objects around Hohenlohe island, the new map differs considerably from its predecessor. In the original map the southern extremity of Crown Prince Rudolf Land is several minutes too far north. I have

---

* The latitudes are practically identical with the provisional results entered on one of the survey sheets.

† The words in the survey sheet are, "Die Kuppe des Ostlandes, 25–30 S. M. fern, ein Cap, vielleicht ein Nordeck einer Insel die nach W. hereintritt."

DETERMINATION OF LATITUDE FROM THE OBSERVED GREATEST ALTITUDE OF THE SUN'S UPPER LIMB.

Date, 1874 ...	March 31.	April 1.	April 3.	April 5.	April 7.	April 8.	April 9.	April 11.	April 12.	April 16.	April 17.
E. longitude ...	3h. 56m. 8s.	3h. 57m. 4s.	3h. 56m. 4s.	3h. 57m. 8s.	3h. 57m. 28s.	3h.57m. 38s. ±	3h. 56m. 8s.	3h 53m. 40s	3h. 50m. 40s	3h. 54m 4s.	3h. 54m. 44s.
ThermometerR.	−20·7°	−16·4°	−13·2°	−2·6°	−13·1°	−12·2°	−8·2°	−12 5°	−11·0°	−14 0°	−12·0°
Barometer ...	766 mm.	765·8 mm.	755·6 mm.	752·8 mm.	759·9 mm	755·8 mm.	754·5 mm.	760·2 mm.	761·1 mm.	747·5 mm.	746·9 mm.
	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″	° ′ ″
Refraction ...	+0 4 21·4	+0 4 10 8	+0 3 58·0	+0 3 37·0	+0 3 44·7	+0 3 39·1	+0 3 30 8	+0 3 27 8	+0 3 25·5	+0 3 0·5	+0 2 53·3
Parallax ...	−8·6	−8·6	−8·5	−8·5	−8·5	−8·5	−8 5	−8·4	−8·4	−8·3	−8·3
Reduction to meridian ...	−0·7	−0·7	−0·7	−0·7	−0·7	−0·7	−0·7	−0·7	−0 7	−0·6	−0·6
Sun's declination ...	+4 8 23·6	+4 31 33·0	+5 17 39·4	+6 3 21·8	+6 48 39·9	+7 11 9·1	+7 33 32·3	+8 17 56 0	+8 39 57 1	+10 6 19·1	+10 27 31·8
Sun's semid. ...	+16 2·1	+16 1·8	+16 1 3	+16 0 8	+16 0·2	+15 59·9	+15 59·6	+15 59·1	+15 58·8	+15 57·8	+15 57·5
Observed Zen. distance ...	75 47 30·0	75 31 0·0	75 11 8·0	74 37 45·0	74 14 45·0	74 0 30·0	73 44 15·0	73 3 0·0	72 58 15·0	70 47 15 0	70 14 0·0
N. latitude by observation	80 16 8	80 22 36	80 48 38	81 0 35	81 23 1	81 31 9	81 37 8	81 40 14	81 57 27	81 12 24	81 0 13
Latitude used in map ...	80 13·4	80 21 3	ditto	80 59·6	ditto	ditto	ditto	ditto	ditto	81 13·4	81 1·3
Map − Observation ...	−2·7	−1·3	—	−1·0	—	—	—	—	—	+1·0	+1·1

located Cape Brorok in accordance with the meridian observation taken there on April 11, together with various bearings of Hohenlohe island; that island in its turn being well determined by several bearings recorded on the 7th and 9th of that month, as well as the latitude of the latter date. Cape Rath, too, seems to be well defined, and there is just a possibility that Cape Buda Pest may also exist as a small island separated from the adjoining land by a narrow strait, somewhat uncertain indications of land in that position having been observed on two occasions.* Andrée island does not seem to exist, except as the eastern end of Karl Alexander Land, there being no certain traces of a strait in the survey. Indeed, the data regarding the whole eastern and south-eastern shores of that land are very uncertain, as the Austrians passed it, for the greater part, in foggy weather. I have marked by red lines those bearings which seemed the most reliable. Deak island is fixed solely by a single, but perfectly reliable, azimuth from the noon station of April 16. Dr. Nansen has kindly shown me his sketches of the southern part of Crown Prince Rudolf Land, together with photographs of the coast near Cape Felder; they confirm Payer's survey sheets in the most satisfactory manner.

In Markham sound the coast-line necessarily remains very uncertain, only a few of the principal capes being laid down from cross-bearings. In the south-west I have restricted myself to indicating the few azimuths that seemed likely to be useful to any future surveyor.

In bringing to a conclusion this endeavour to utilize to the most the cartographic materials collected by Payer and Weyprecht, I cannot but express my admiration for the skill and energy displayed by those distinguished explorers. To Weyprecht, geography is indebted for the thorough manner in which he imparted to the fundamental points of the map all the accuracy with which he had determined the position of his astronomical observatory. To Payer's daring in extending his survey to so great a distance from the ship, no less than to his skill and indomitable energy, we owe our first map of Franz Josef Land, in which, in spite of imperfections, the region traversed by him is laid down in such a way that any explorer following in his track will be able to correct the few oversights inevitably incidental to a first exploration.

THE NEW RAPID ON THE YANG-TSE.

THE following extracts, giving some account of the new rapid on the Yang-tse, caused by a landslip, are from a letter from Mr. F. S. A. Bourne, H.B.M. Consul, who is in charge of the Blackburn Commercial Mission to China. It is dated—

On the Yang-tse off Feng-tu Hsien, December 18, 1896.

Messrs. Neville, Bell, and myself, accompanied by Mr. Cecil Hanbury, of Shanghai, whom I had invited to join us on the junk voyage from I-chang to Ch'hung-king, arrived at K'uei Fu in lat. 31° N. and long. 109° 30′ E. on December 1. We heard in more precise terms here news, the rumour of which had rather disconcerted us at I-chang, "that a hill had fallen into the river and made a fearful rapid that we certainly could not pass." On December 6 we reached the small town of Yün-yang, and learnt that the magistrate had that morning left for the new rapid. The next day we left Yün-yang at dawn, and, after passing through high mountains

* The Norwegian explorers, however, who passed within about 15 miles of Cape Rath, saw no traces of any island in the position indicated.

flanked by slopes of red shale, now covered with the fresh green of beans and wheat, we came in sight of the rapid at noon. Mr. Hanbury and I had landed early in the morning, and had delayed at a very interesting chai-tzŭ, or village fort of refuge, on the north bank, where we noticed ancient Man-tzŭ bricks with very curious designs, an account of which I will give in a future letter.

Viewed from a distance, the new rapid somewhat belied our expectations. We had been told again and again on the way up that a mountain had fallen into the river, and we had expected to see a precipice overhanging the stream; but the height on either side looked at least half a mile from the bank. As we approached, however, an extraordinary scene presented itself; the river was suddenly contracted from 300 yards to a breadth of 80 yards only, and over this space rushed a mighty fall of water, far more than the most dreaded of the rapids we had passed. We all agreed that no steamer of whatever power could stem this torrent, and it appeared impossible a boat of any sort could be dragged up such water. The current in the middle is very fast, and on either bank huge waves are thrown up by the water dashing against the rocks below. As our eyes fell upon it for the first time, a large Ssu-chuan junk coming down stream struck a rock in the trough of the waves and was a wreck in three minutes.

Further examination showed that there had been an extensive landslip on the north bank, and that a block of ground, measuring about 700 by 300 yards, had fallen from the slope of the mountain, encroaching about 150 yards on the bed of the river. The sketch-map appended, which has been drawn by Mr. Hanbury, with the assistance of bearings taken by me with a prismatic compass and of a traverse, will give a better idea of what has happened than words. The space within the dotted line represents the area of the landslip, the northern edge of which fell vertically about 200 feet, bringing down huge blocks of hard sandstone, which had formed a deep bluff above the line of fissure. Below the hard sandstone bluff above mentioned the strata had split vertically, and the whole mountain-side had slid down horizontally a distance of 100 to 150 yards. Before the landslip, the surface going south appears to have been much as follows: The main ridge of the mountain about 1000 feet above the river; the hard sandstone bluff about 600 feet above the river, with a few pines growing above it; a slope at an angle of 30° to 45°, with boulders and t'ung oil trees; an undulating surface cultivated with paddy and sugar-cane, breaking down to a sand-slope; and then hard sandstone dipping to east-south-east at an angle of about 15°, which formed the bank of the river, where the towing-path was at low water. *Now* the same space is occupied as follows: Under the sandstone bluff, carrying down some 150 yards of it, is a vertical cliff where the mountain has been rived as if cut with a knife. At the bottom of this cliff, 200 feet high, huge blocks of sandstone from the bluff, broken by their fall, lie in a confused mass with fir trees prostrate, truncated, and at all angles. Below this come t'ung oil trees that have been carried down vertically 150 feet, but are yet fairly erect, with their roots in the ground. Then a curious narrow ridge of soft sandy earth, very steep, 50 feet above the level of the ground around it, appearing to have been forced up from below by the heavy fall of stone. Then a banyan tree, of a girth of 19 feet, which has been carried along bodily a distance of 100 yards, together with the rocks around which its roots are wound. To the west of the banyan tree is an old pathway which has been cut in two, the part upon the landslip being on about the same level, but 80 yards south of the part *in situ*, marking exactly the distance the slip has travelled on this side. South of the banyan tree is a sugar-mill, which shows curiously the form the slip has taken at this point; the bed of its crushing-wheels is thrown from the horizontal to an angle of 15°, dipping to the north, that is, away from the river. The mill is

said to have been on the top of a hillock, which appears to have been carried on and up, and may rest on the top of the old sandbank. Sugar-cane here has been carried

south about 80 yards, but is growing as if nothing had happened. The southern face of the slip presents to the river a bluff formed of a *débris* of loose mud and sand, with blocks of stone interspersed, 30 to 80 feet above the stream, and scarcely yet settled down. At the eastern extremity is a point (A on the map), the

immediate cause of the rapid, running straight out into the river just where the stream is hemmed in on the south by a bluff 60 feet high, part of a reef of very hard sandstone that runs for miles. The point was, no doubt, at first of the same nature as the bank, but the river while in flood has washed out the loose mud and sand, and has left a most formidable heap of huge blocks of hard sandstone and jagged shale that have not been subjected to the rounding action of water; it bristles with sharp points, too cruel even for the cypress hull of a Yang-tse junk to touch.

The new rapid I found to be situated in lat. 30° 54′ 30″ N.; its longitude may be estimated, from Blakiston's chart, at 109° 16′ E. It lies about half a mile above a small rapid called Ta-chang-tzu. There was no rapid here before the landslip, but a bay, it is said, and this is borne out by the name of the place, Lung-ching-wan, meaning Bay of the Dragon's Ford. The country on either side of the slip consists of slopes and hillocks of sand and clay coming down at an average angle of 30° towards the river from the main ridge, and divided by spurs of higher ground or secondary ridges at right angles to the main ridge, and to the river. The landslip consisted of the whole tongue of sloping hillside lying between two of these spurs, and it seems to have come down with a strong swing in the direction of the eastern spur, a point I shall notice later. On the east and west lines of fissure, blocks of stones have been thrown out resembling, near the river, the terminal moraine of a glacier, and along these lines small streams are working out a channel to the river.

The landslip occurred at 10 p.m. on September 30, 1896, after forty days of incessant rain. It seems that no one was killed, although we saw two houses that were wrecked and carried some 100 yards. The farmer who lives at the house on the west of the slip has been a heavy sufferer; his ancestral paddy land is gone under 40 feet of rock and *débris*, but he and his household of twenty mouths were lucky to escape with their lives: the slip passed within 20 yards of their door. The natives describe this landslip as a scooping movement, as if the earth had sunk in the middle of the slip and been piled up on the south, and there is evidence of something of the kind having happened, for there are two small lakes on the slip, and the surface rises towards the river. This is far from the only landslip caused in this neighbourhood by the excessive rains of last September. We noticed in our walks several smaller slips, and we heard of two very serious ones. The Sias Kiang, a tributary of the Yang-tse, on the north bank a few miles west of this, was said to be blocked to traffic by a slip of a similar nature; and a homestead embracing the whole family of a Master of Arts (*chü jĕn*), named Hwang, at a place called Chang-chia-wan, 20 miles from the north bank, was engulfed in a slip, which fell from the mountain-side into a deep valley, and buried in the bowels of the earth the houses and their sixty inhabitants.

In regard to the nature of the landslip, it should first be noted that the rocks which split vertically are, below, a very lightly compressed friable grey sandstone, and, above, a soft red sandstone. These probably rest on a very hard sandstone. These rocks all lie in stratification, and dip about east-south-east, a few degrees only removed from the direction of the slip. One may, perhaps, venture the following theory: the overlying soft rocks split under the weight of the mass above them saturated with rain, and slid along the dip of the hard sandstone beneath. This theory is borne out by the direction taken by the slip, which clung close to the ridge on the east, throwing up a big moraine of stone along the edge of fissure, besides pushing out point A; while on the west, at the side farthest removed from the direction of the dip, there was a smaller movement, and less disturbance.

Three months ago there was but one house here, now there is a busy town of

mat-shed shops—some four or five hundred. The place is full of trackers and the agents of merchants and junk-owners, and presents a most animated scene, suggesting a mining-camp. In the foreground pigs are being killed and food of all sorts prepared and offered for sale; trackers come labouring along, often fifty to one hawser; coolies pass and repass, carrying all manner of goods across the rapid; and the neighbouring slopes are adorned by square acres of Yorkshire lastings and long-ells, wrecked cargo spread out to dry—a field of gay colours; while in the distance on the flats beyond the river Indian cotton yarns form a white background, the whole set off by noble mountains, the lower slopes of which are green with young wheat and beans.

The effect of this rapid on the traffic is very serious indeed. For some time after the landslip the river remained very high, junks passed over the point, and the amount of damage to the river's channel was not known. In November all up-traffic was stopped. Not till the river had fallen much further, on December 4, were junks hauled up again. All junks, whether bound up or down stream, have to unlade, and then cargo has to be carried over land for half a mile. Downward-bound junks then shoot the rapids in the middle, and upward-bound ones are hauled over just under the point, by sheer weight of trackers, three to six bamboo hawsers and an equal number of stays being used to each junk. Both processes are very dangerous, and the merchant has not only to bear the extra expense, but to guarantee the junks against loss or damage. The junks hauled up seemed to us to be kept off the rocks beneath them by the tremendous force of the water under their hulls—of keel, of course, they have none, and they are, as I have said, empty A hundred junks and a thousand lives have been already lost, we were told. The average cost of crossing the rapid may be put at one to two per cent. on the value of the cargo. About five hundred junks were lying at the rapid when we passed, the cargo on which may be roughly valued at £800,000. When the immense exchange of products between the lower Yang-tse provinces on the east, and Szu-chuan and North Yunnan on the west, is remembered, and that there is no other route practicable, the seriousness of this rapid can scarcely be exaggerated.

As there was no rapid here before the landslip, there can be no great difference in level * between the river above and below the obstruction, the removal of which would, one imagines, present no great difficulty to a foreign engineer; yet, far from taking any steps to get the obstruction removed, the local government, with the help of subscriptions from merchants in Wan Hsien and Ch'ung-king interested in the river traffic, is constructing roads on both banks for the portage of goods, as if the rapid were to remain a permanent bar to navigation.

I am afraid you will be weary of this letter, particularly of the details in regard to the landslips, but to us on the spot these details were intensely interesting; we could not but feel that we were face to face with one of those great forces that have laid down the surface of the Earth, and that such a chance of studying its action fell to the lot of few. And I must ask your indulgence for the deficiencies of this letter; it was written in a Chinese junk without the help of a library. I must ask the same indulgence for the map. The photographs, taken by Messrs. Neville, Bell, and Hanbury, who had to work under even greater disadvantages, have unfortunately not turned out well, for a worse place for photography and map-drawing could scarcely be found.

---

* This I believe to be the case at most, if not all, the rapids between I'chang and Ch'ung-king. They only exist because the channel is contracted, usually by a boulder bed brought down by a torrent from the mountains, and not because of a great difference in level. They resemble mill-races rather than rapids.

THE POPULATION OF RUSSIA.

By P. KROPOTKIN.

THE figures relative to the population of Russia which were obtained at the recent census lead to several important geographical conclusions, some of which have been indicated by P. P. Semenoff in the report on the census which he read before the Russian Geographical Society on May 19,* while some others will be indicated in this paper.

From the items which were given in the June issue of the *Geographical Journal*, it was seen that the population of European Russia proper has attained this year 94,188,750 inhabitants, while the population of all the non-Russian provinces of the empire is 35,022,363, of which 2½ millions are in Finland, nearly 9½ millions in Poland, 9¾ millions in Caucasia, nearly 3½ millions in the Kirghiz steppes, 4¼ millions in Turkistan and the Transcaspian territory, and 5¾ millions in Siberia.

At present the chief interest attaches to the distribution of the 94 millions of which the population of European Russia is composed, the last census giving most valuable data as regards its density in different parts of the territory, as well as the changes which took place in its geographical distribution within the last fifty years. In order to render these data more comprehensive, I have compiled the following table, in which the fifty provinces of European Russia are arranged into a number of natural groups, and the increase of population since the year 1851 is given for each group separately. I have also calculated the density of the population per square mile for each province separately, and I reproduce from the official census reports the relative proportions of males and females for each province of European Russia and for the other main divisions of the empire.

TABLE A.

Provinces.	Population.		Increase per cent. in 46 years.	Density in 1897. Inhab. per sq. mile.	Number of women per each 100 men. 1897.
	1897.	1851.			
Arkhangelsk	347,560	234,064	—	0·2	111·0
Olonets	366,647	263,409	—	1·2	110·9
Vologda	1,365,313	864,268	—	1·4	108·6
Northern provinces ...	2,079,520	1,361,741	53	—	—
Perm	3,002,655	1,741,746	—	3·7	107·0
Vyatka	3,082,615	1,818,752	—	8·2	109·2
Northern Urals	6,085,270	3,560,498	71	—	—
Novgorod	1,392,931	891,037	—	4·7	107·1
Pskov	1,136,580	657,283	—	10·9	106·0
St. Petersburg	2,104,511	566,409	—	19·5	87·4
Lake district	4,634,022	2,114,729	119	—	—
Livonia	1,300,401	821,457	—	11·8	106·3
Esthonia	413,724	289,800	—	8·7	103·3
Courland	672,539	539,270	—	10·2	105·8
Baltic provinces	2,386,664	1,650,527	54	—	—

* It was published in the Russian *Official Messenger*, Nos. 106, 107, and 108.

Provinces.	Population.		Increase per cent. in 46 years.	Density in 1897. Inhab. per sq. mile.	Number of women per each 100 men. 1897.
	1897.	1851.			
Vilna	1,591,912	787,609	—	15·7	100·4
Grodno	1,615,815	795,604	—	17·3	95·5
Kovno	1,549,972	875,196	—	16·0	103·5
Lithuanian provinces ...	4,757,699	2,458,509	94	—	—
Vitebsk	1,502,895	742,811	—	14·2	100·6
Minsk	2,156,343	935,345	—	9·7	100·0
Moghilev	1,707,613	837,537	—	14·6	101·7
White Russia	5,366,851	2,515,693	105	—	—
Smolensk	1,550,973	1,069,650	—	11·3	109·0
Kaluga	1,178,835	941,402	—	15·8	116·2
Western Central	2,729,808	2,011,052	35	—	—
Tver	1,812,559	1,359,920	—	11·6	119·4
Yaroslav	1,073,593	943,426	—	12·5	133·0
Kostroma	1,428,893	1,020,628	—	7·0	117·1
Moscow	2,433,356	1,348,041	—	30·1	83·2
Vladimir	1,570,730	1,168,303	—	13·4	114·2
Nijni-Novgorod	1,603,034	1,126,493	—	13·0	110·7
Moscow industrial region	10,922,165	6,966,811	57	—	—
Tula	1,431,322	1,092,473	—	19·0	111·4
Orel	2,054,609	1,406,571	—	18·1	105·1
Kursk	2,394,893	1,665,215	—	21·3	101·7
Ryazan	1,827,537	1,308,472	—	18·0	111·2
Tambov	2,715,265	1,666,505	—	16·9	104·4
Penza	1,483,948	1,058,444	—	15·8	105·8
Northern black-earth region	11,907,574	8,197,680	45	—	—
Kazan	2,190,075	1,347,352	—	14·2	103·1
Simbirsk	1,550,458	1,024,286	—	12·7	106·7
Saratov	2,419,756	1,444,496	—	11·8	103·5
Middle-Volga provinces	6,160,289	3,816,134	61	—	—
Podolia	3,031,040	1,577,966	—	30·0	82·1
Volhynia	2,999,346	1,469,442	—	17·3	98·2
Kieff	3,564,433	1,636,839	—	28·8	79·6
South-western provinces	9,594,819	4,684,247	105	—	—
Voronej	2,547,320	1,629,741	—	16·0	101·0
Poltava	2,794,756	1,668,694	—	24·1	101·4
Chernigov	2,322,007	1,374,746	—	18·2	103·6
Kharkov	2,510,378	1,366,188	—	18·9	98·1
Ekaterinoslav	2,112,651	788,179	—	13·8	94·1
Little Russia	12,287,112	6,827,548	80	—	—
Bessarabia	1,936,403	874,044	—	18·0	94·8
Kherson	2,728,508	889,205	—	16·0	95·3
Taurida	1,443,835	608,832	—	9·9	89·8
Don	2,575,818	907,948	—	6·5	98·1
Southern provinces ...	8,684,564	3,280,049	165	—	—

Provinces.	Population.		Increase per cent. in 46 years.	Density in 1897. Inhab. per sq. mile.	Number of women per each 100 men. 1897.
	1897.	1851.			
Astrakhan	1,002,316	386,763	—	1·7	95·5
Samara	2,761,851	1,320,108	—	7·2	102·4
Ufa	2,219,838	956,447	—	7·4	99·6
Orenburg	1,608,388	689,269	—	3·5	100·3
South-eastern provinces	7,592,393	3,352,587	126	—	—
Total, European Russia	94,188,750	52,797,685	78	8·0	102·8
Poland	9,442,590	4,852,055	95	30·6	98·6
Finland	2,527,801	1,636,915	55	3·2	102·2
Caucasia	9,723,553	4,436,152	—	9·3	89·5
Siberia and Sakhalin ...	5,731,732	2,437,184	135	1·8	93·7
Steppe region	3,415,174	1,220,654	180	0·6	89·4
Turkistan and Transcaspian	4,175,101	—	—	2·5	83·0
Russians in Bokhara and Khiva	6,412	—	—	—	99·9
Russian Empire	129,211,113	67,380,645	92	2·5	100·0

A few remarks must be made concerning the value of these figures. The earlier censuses of Russia were not censuses at all, in the sense that now attaches to the term. They were mere enumerations of the "tax-paying" peasant and small artisan population, which enumerations—as P. P. Semenoff remarked in his report—"supplied almost no data for science, were of little value for the administration, and were hateful to the population." Still, the data which were collected in this way in 1851 were supplemented from various sources, and worked out in a more or less scientific way, by Koeppen; they may thus be taken as approximately reliable, in preference to the figures of a later enumeration which was made in 1858. They are given in the second column of the above table. As to the figures obtained during this year's census, they may be considered as quite reliable, within certain reasonable limits of possible error. To take that census, an army of 150,000 enumerators was set to work for three months—a great proportion of them being volunteers (more than a thousand students of the University and the High Schools took part in the census at St. Petersburg). The lists were made for each family separately, and they contain the name, the sex, the age, the mother-tongue, and the profession of each individual. Such lists will evidently make it possible to determine the number of persons of each age in the population, and to compile at last a reliable ethnographical map of the Russian Empire.

In the mean time, we can already see that considerable changes took place in the geographical distribution of the population of European Russia within the last forty-six years. From the third column of the above table A, it is evident that the increase of population has varied very much in different provinces. In some of them, possessed of a meagre clayey and sandy soil, the increase was as low as 35 per cent. in forty-six years, while in the provinces on the Black sea the average increase was 165 per cent., and even rose to 207 per cent. in Kherson.

True that the figures of the last census do not represent the *permanent*, but only the winter population. In Russia hundreds of thousands of peasants leave their abodes every winter, and wander south and north, towards the large towns, or to the fertile prairies, in search of work.* This sort of temporary migration is also very well illustrated by the extraordinarily high proportion of women in the population of certain provinces, which is seen in the census figures (table A). Thus, in Kaluga, which I know personally, the very high percentage of women (116 women for each 100 men) depends entirely upon the fact that a considerable proportion of the male population go in winter to South Russia in search of work as carpenters; they go chiefly to Kherson, where we find, indeed, the reverse proportion of only 95 women for each 100 men. In Tver, the similarly high proportion of women (117 women for each 100 men) is due to the men going in great numbers to St. Petersburg, to work in the textile factories during the winter months. In both these cases, and in fact in all others, the disproportion between the male and the female elements of the population would not have been so great if the census had been taken in summer, when the Kaluga and Tver people return home in order to work in their fields; but the same disproportion would then appear in other provinces, from which a considerable number of men migrate southwards, to work at haymaking in the southern prairies. However, even if these temporary causes were eliminated, very considerable differences in the rate of increase of the population would be none the less quite apparent.

The fact is—and this fact has an immense importance for the general development of Russia, its history, and its further progress—that the centre of gravity of the population of European Russia has been shifted within the last fifty years southwards, towards the shores of the Black sea. A hundred, and even fifty, years ago the chief bulk of the population of European Russia was in Central Russia, round Moscow; there being at the same time another centre of dense and numerous population round, or rather south-west of, Kieff. Now the main centre of dense population has been shifted southwards; and, while in Central Russia the population has been increasing more slowly than on the average in European Russia, in the southern parts of the territory the population was doubled and nearly trebled. Russia may be said to move southwards to the Black sea. In South Russia, especially since a prodigious development of agricultural home-made machinery took place,† and since culture on a large scale was introduced in the fertile "black earth" prairies, we find the densest agricultural population. There we find also the greatest number of populous towns, all of recent growth. If we take the towns having more than 75,000 inhabitants, we find that, with the exception of St. Petersburg and Riga, they are all situated to the south of Moscow, and that quite a number of large towns, which were quite insignificant spots fifty years ago, have grown up, either in the south of Kieff, nearer to the Black sea, or in the south-east on the lower Volga. Such are Kharkov (170,682 inhabitants), Saratov (133,116), Ekaterinoslav (121,216), Rostov-on-Don (nearly 150,000), Astrakhan (113,075), Baku in Caucasia (112,253), Kishineff (108,506), Nikolaeff (92,060), and Samara (91,659); to say nothing of a number of southern towns like Elisabethgrad, Kremenchug, Tsaritsyn, Berdicheff, Novocherkask, and Taganrog, which all have populations of more than 50,000. They have all grown up recently in

* The proportions of this migration may be judged from the figures which I gave in the descriptions of separate Russian provinces (K to Z) in the 'Encyclopædia Britannica.'

† See the British Consular Reports in connection with the Nijni-Novgorod Exhibition.

South Russia, on or in the vicinity of the Black sea, and they are centres of either a considerable trade or of some important branch of industry. Besides, a very great number of populous villages in that region have rapidly become important small towns.

It may thus be said that the Baltic sea loses more and more of its importance for Russia, while the Black sea, and also the Caspian, acquire more and more importance in proportion. This is the fundamental fact which is brought into prominence by the last census.

Its geographical bearing is extremely interesting. The structure of the surface of European Russia may best be represented by stating that a broad plateau, deeply ravined by river valleys, crosses the territory from the south-west to the north-east; that is, from the Carpathians to the middle Urals. It slopes on the north-west towards the lake district and the double valley of the Sukhona and Vychegda (the two rivers which flow to meet each other and form, after their confluence, the Northern Dvina); and in the south it slopes towards the Black sea, the Sea of Azov, and the depression on the northern coast of the Caspian sea. Several separate depressions, which formerly were elongated gulfs of the Caspian sea and, later on, great lacustrine basins, are sunk into the plateau (the chief of them being that of Nijni Novgorod). This leading orographical feature of European Russia, which formerly was well understood by geographers, has unhappily been obliterated on recent hypsometrical maps, which, like all hypsometrical maps that are drawn with an insufficient number of contour-lines, have the drawback of obliterating the less pronounced yet important orographical features of a plateau-shaped territory. Nevertheless, all the physical and economical features of European Russia may be indicated on a map, in striking conformity with this leading feature of Russia's orography. The maps of distribution of various soils, of agriculture, of productivity of crops, of imported and exported corn, of agricultural well-being, of climate, and —we now see—of density and increase of population, can all be shown to be dependent upon the just-mentioned leading orographical feature. When we consider the figures of the last census from the geographer's point of view, we may interpret them as follows:—Formerly the Great Russians occupied the northern slope of the above-mentioned plateau, but gradually, since the seventeenth century, they began to spread along its northern edge. Next they spread on its surface; and since the end of the last century, when Turkish rule was abolished on the Black sea, they spread down the southern slope of the plateau, to the shores of the Black sea, the Sea of Azov, and the Caspian. At the present time as much as two-thirds of the whole population of European Russia is concentrated in the "black-earth" region, which covers less than two-fifths of the aggregate territory.

The table A fully illustrates this conclusion. We see, in fact, that the greatest increase of population took place in the southern "black-earth" and steppe-like parts of the plateau—the group of south-western provinces and Little Russia—and on its southern slope, in the provinces of Bessarabia, Kherson, Taurida, Don, and Astrakhan, where the increase of population was more than twice as high as the average increase for European Russia altogether.

Instituting a more detailed examination, and partly following P. P. Semenoff's address, we find that (leaving aside the two capitals, Moscow and St. Petersburg) the densest population is in the south-western provinces of Podolia, Volhynia, and Kieff; in Little Russia (Voronej, Poltava, Chernigov, Kharkov); as well as in the group of the "northern black-earth region" (Kursk, Tula, Orel, Ryazan, and Tambov). In some parts of the last-named region, the agricultural population is altogether so dense that a considerable emigration to Siberia has taken place recently from the five last-named provinces. Consequently, the rate of increase of population was only 45 per cent. in forty-six years in these five governments.

In the Black sea provinces (Bessarabia, Kherson, Don, and Crimea) the increase ranges from 120 to 207 per cent., this last formidable increase having taken place in Kherson, where the population, attracted as it was by a very fertile, mostly unoccupied soil, by mining, and by the large city of Odessa, has more than trebled. The same is true of the south-eastern provinces on the lower Volga and in the Southern Urals, *i.e.* Samara, Ufa, Orenburg, and Astrakhan, where the increase was from 109 to 160 per cent., large towns also growing up in the mean time.

A strikingly small increase is found, on the other side, in the manufacturing region round Moscow, which contains nearly two-thirds of all the great industries of European Russia. In that region, notwithstanding the rapid growth of the capital itself, which now has nearly a million inhabitants, the increase was only 57 per cent., that is, much below the average increase for all European Russia.* As to the partly manufacturing provinces of Kaluga and Smolensk, which are possessed of but a very meagre soil, the increase of their population was still smaller (respectively 43 and 25 per cent.). Two other regions of very low rate of increase are found also in the lake district (Novgorod and Pskov) and in North-Eastern Russia, where the increase was only from 40 to 58 per cent. in forty-six years, notwithstanding the scarcity of population. As to the capital, St. Petersburg, its population has trebled within the same period, and now exceeds 1¼ million.

A notable feature is the rapid increase of population in the three Lithuanian provinces and the three provinces of White Russia. In only one of them, Kovno, the population has not doubled since 1851, while in the others the increase was from 100 to 137 per cent. The rapid multiplication of the Jews, and their better enumeration ("they have admirably well supplied all data for this census," M. Semenoff remarks), and especially the advantageous conditions under which the serfs were emancipated in the Lithuanian provinces (the Polish landlords were compelled, after the unsuccessful insurrection of 1863, to grant larger allotments and to receive smaller redemption for the liberation of their serfs than the Russian landlords in European Russia proper), fully explain, in Semenoff's opinion, that rapid increase.

As to Poland, which is the most densely peopled part of the empire, its population has nearly doubled since 1851 (increase 94 per cent.), and, what is still more remarkable, this high rate of increase was maintained within the last twelve years as well, while in several other parts of Russia the increase which took place in previous decades slackened recently. A good climate, a fertile soil, and an absence of droughts, which are so painfully felt in South-Eastern Russia, the specially favourable conditions under which the ex-serfs were liberated, the rational culture which spreads amongst the peasants as well, the rapid growth of industry, and partly also the German agricultural immigration, which was favoured by the German Government, explain this rapid increase.

As to Caucasia, its population has grown from 4,436,152 inhabitants in 1851 to 9,724,000; but this is not due to annexations—only 447,000 inhabitants having been annexed in 1878.† It is due partly to better methods of enumeration, but especially to the rapid colonization of Northern Caucasia by the Russians, as also, undoubtedly, to a local increase of population in Transcaucasia, where agriculture attains a high degree of perfection (in Tiflis and Kutais), while Baku has become a great industrial centre owing to its naphtha wells. The two

* The high percentage of women in that region shows that a considerable number of men must be absent in winter-time; but all allowance being made for that cause, the increase would still be very small.

† Against which might be set the loss by the depopulation of Abkhasia, now shown as uninhabited in the official maps.—Ed. *G.J.*

provinces of North Caucasia—Terek and Kuban—have now become, partly in consequence of immigration, and partly in consequence of natural increase (number of births as high as 55 in the thousand), important centres of Russian population—a very considerable number of small Cossack villages having lately become towns with 10,000 to 20,000 inhabitants.

As to Siberia and the Kirghiz steppes, they are being rapidly colonized by Russian emigrants. The province of Tobolsk is now thoroughly Russian, and it appears that even in the provinces of the Amur, Maritime, and Sakhalin there is already no less than 350,000 inhabitants, almost entirely Russians.

A question of great interest arises in connection with the last census, namely, what are the respective numbers of the different nationalities of which the Russian empire is composed? The lists of the census will undoubtedly give a complete answer to this important geographical question. It will take, however, much time to work out these data of the census, and in the mean time I have attempted to roughly compute what may be the number of Russians in that heterogeneous empire. For that purpose, I have availed myself of the percentages of different nationalities in Russia which were published some twenty years ago by Rittich.*

Taking Rittich's percentage figures and the data of the last census, the following table, which of course represents but a rough estimate, could be computed for European Russia:—

TABLE B.

Groups of provinces.	Population.	Great Russians.	Little Russians.
Northern and Baltic provinces	6,572,000	3,600,000	—
Lithuania, White Russia, and South-West Russia	19,719,000	200,000 (6,800,000 White Russians)	8,810,000
Little Russia and Don ...	12,750,000	4,000,000	8,400,000
Central Russia	28,082,000	26,100,000	1,000,000
Volga provinces	9,923,000	6,100,000	3,800,000
North-East Russia	9,913,000	7,400,000	100,000
Southern provinces	8,222,000	1,300,000	4,300,000
European Russia	94,081,000	49,700,000 (7,900,000 White Russians)	26,400,000

It may thus be said that there are in European Russia about 83,000,000 Russians out of 94,000,000 inhabitants, *i.e.* nearly 50,000,000 Great Russians, over 26,000,000 Little Russians, and about 7,000,000 White Russians (Byelorusses). There are, moreover, more than 3,000,000 Russians (Great and Little Russians) in Caucasia (chiefly in Cis-Caucasia), over 1,000,000 Russians in the Kirghiz steppes territory, and over 5,000,000 Russians in Siberia, as against less than 750,000 natives. The Russians thus make a little over two-thirds of the total population of the empire, and they are settled in three compact bodies—in Russia proper, in Northern Caucasia, and in Siberia.

* 'Plemennoi Sostav Kontingentov Russkoi Armii,' by A. E. F. Rittich. St. Petersburg. 1875.

A PORTABLE MERCURIAL BAROMETER.

By Captain H. H. P. DEASY.

This barometer, which was first used by Dr. J. Norman Collie, F.R.S., Professor of Chemistry, Pharmaceutical Society of Great Britain, consists of two glass ends of the same diameter, 0·4 of an inch, joined together by specially made rubber tubing of very small bore, capable of withstanding a long-maintained vacuum. The upper end is about 2·5 inches long, and contains an air-trap, into which all the air that may accidentally enter the barometer, either through the tap leaking, through the rubber tubing, or through either of the joints, must find its way. The lower or reservoir end is about 4·5 inches long, and has an air-tight tap about an inch below the broad part. These ends are forced into the rubber tubing, and, as an additional precaution against leakage, copper wire is bound round the joints. The scale is cut on an aluminium bar, along which two carriages, to which the barometer is attached, move up and down, and they can be clamped to the bar at any place (*vide* diagrams). By means of the verniers attached to the carriages, which are divided to 0·002 of an inch, it is very easy to estimate the height of the mercury to 0·001 of an inch.

THE BAROMETER IN ITS NORMAL WORKING POSITION.

To use the barometer, the carriages are put on the scale bar; the lower one is clamped at the bottom of the bar, and the upper one some inches higher up; the barometer is attached to the carriages by clamps which fit over the joints; the rubber cap is removed from the reservoir end, the tap opened, the verniers put in the middle of their runs, and the upper carriage moved up the bar until there is a vacuum. By means of the screws on the right of the mercury, the verniers are moved up or down until the top of the mercury at each end is in line with the edges of the rings attached to the verniers, and which fit round the glass ends. The rubber cap on the reservoir end is merely to prevent the small quantity of mercury, which should be left above the tap when it is closed, from being shaken out when travelling.

To pack up the barometer, lower the upper carriage *very slowly* until the mercury has touched the top of the glass; then detach the barometer from this carriage, and either let the upper end hang vertically below the reservoir, or detach the reservoir end from its carriage and raise it till the barometer hangs vertically. By this means the barometer is completely filled with mercury, and then the tap must be closed. The reason for doing this is to render it quite impossible for air to enter the barometer when it is not in use, as when thus filled and packed away the mercury is endeavouring to get out of the barometer. This is easily proved by carrying out the above directions, laying the barometer down on the ground or table, etc., raising the reservoir end, and opening the tap, when the mercury will at once rise in the reservoir. The barometer, with a thick soft cap at each end, is packed in a rectangular box about $11\frac{3}{8} \times 9\frac{1}{2} \times 3\frac{3}{4}$ inches, coiled round a partition containing the carriages, a small bottle of mercury, a small exhaust-pump, and a very small tin of composition to apply to the tap if required. A short length of tubing is put at the bottom of the box, and is required

to connect the pump to the barometer in case of air getting in, but the pump is seldom required. The total weight of this box and barometer, etc., is about 7½ lbs. The scale-bar and travelling-case weigh about 6½ lbs. Casella, who is the sole maker, is now making a lighter scale-bar and lighter carriages, so the total weight of the new instruments complete will be reduced.

If the instrument is packed as I described—in a well-padded box—it is quite unnecessary to take any further care with it when travelling. Should a traveller wish to carry a spare barometer, it can be carried in a well-padded box about 8¼ inches square by 4⅝ inches deep, weighing, when full, about 3¾ lbs.

It was in a box of this description that I carried the barometer, which was exhibited before the Royal Society on May 19, 1897, on my recent journey into Western Tibet, of which country about 24,000 square miles were surveyed by me and the sub-surveyor, who was detailed by the Survey of India to accompany me. This particular instrument was used about two hundred and eighty times, and required to be pumped only twice. It was carried—chiefly on mule-back—over thirty-three passes, varying in height from 11,500 to over 19,200 feet, and was sent from Umballa to Bombay as an ordinary parcel, and thence shipped as ordinary cargo to London, where it arrived quite safely.

This instrument withstood a very severe test, to which it was accidentally submitted in India. It slipped off the seat of the carriage in which I was driving, and fell on to the metalled road. Although the best pace of hired animals in India is not very rapid, it was on this occasion quite sufficient to prove that this barometer, packed as described, can safely undergo a considerable amount of very rough usage. I would like to allude to the alleged drawbacks to this barometer, and to reply to them.

First, it takes a long time to set it up and take readings. I admit that the directions are somewhat lengthy, but it does not take long to carry them out—only about ten minutes to unpack, set up, read, and repack.

Second, it may require pumping often. I used one about 280 times, and it required pumping only twice, and the older the instrument the less likely is it to require pumping. Leakage would, of course, occur more easily when high pressures were being measured.

Third, it is hard to exhaust from it any air that may accidentally get in, and, besides, it takes a long time. This operation is not difficult, and, with a proper pump, should not take half an hour to perform.

Fourth, the presence of air in the instrument causes false readings. I compared the readings of my barometer, with air in the air-trap, with those of two standards, and all three readings were identical. As long as air does not go beyond the air-trap, the readings are not affected thereby.

Fifth, one critic—a very competent one—considered the handle of the tap, the neck joining it to the tap, very fragile. This is the strongest kind of handle, and the quality of glass used is exceedingly tough, so that there need not be any fear of the handle being wrenched off. Spare taps may be carried and easily fitted in place of a broken one.

Sixth, an error of reading would occur, owing to the meniscus of the mercury in the narrow top and bottom cisterns. This would not be the case, for the reading in the upper part of the barometer would be too high by exactly the same amount as that in the bottom part, and the two errors would counterbalance one another.

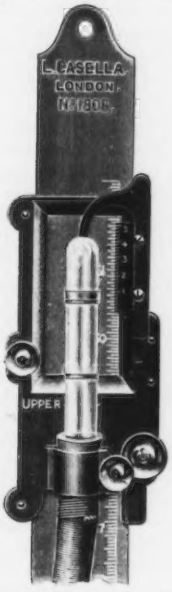
Seventh, there is no attached thermometer. Not required for all ordinary purposes, as, by exposing the instrument thoroughly for a few minutes, it will then have the same temperature as the surrounding air, which is easily ascertained

by suspending a thermometer from the clamp-screw of the upper carriage, or from any other place close to the instrument.

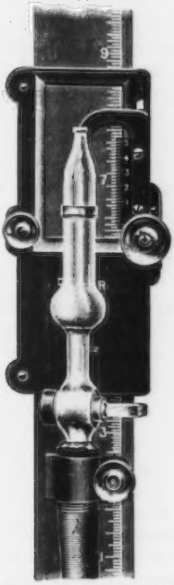
Eighth, the rubber tubing becomes stiff in cold weather, and will not last long. The tubing of the barometer which I used in Tibet was perfectly pliable at a temperature of $\pm 0°$ Fahr., and did not show any tendency to becoming stiff. Time alone will prove for how long this tubing, which is made of the very best materials, will last; but I should think it will remain perfectly good for several years, and it can easily be replaced without returning it to the maker.

Ninth, the mercury soon becomes dirty and discolours the glass. Yes; but only in the reservoir end, which is open to the air, and it is easily cleaned with a piece of cotton-wool attached to a wire or stick.

Tenth, if, by any means, a large quantity of air got into the instrument, it might easily get above the air-trap and render the barometer useless until the



THE UPPER CARRIAGE AND VERNIER, WITH BAROMETER ATTACHED.



THE LOWER CARRIAGE AND VERNIER, WITH RESERVOIR END OF BAROMETER ATTACHED.

mercury was re-boiled. Quite recently, while testing a piece of new tubing which was thought to be defective, the barometer was set up and left open, with about half an inch of vacuum, during the night. On examining it next morning, the upper part was found full of mercury, the air-trap was full of air, and there was a considerable amount of air in the tubing as well.

Having referred to the alleged drawbacks, I think it will not be out of place for me to mention that this kind of barometer requires no special care when packed as described by me; is capable of withstanding a considerable amount of rough usage, exposure to great changes in temperature, without being opened; is very easily and rapidly set up and read; the error, if any, is constant, and it will last for several years without requiring new tubing. A spare barometer of this pattern, which

reached me when I was on my way to Tibet, having proved defective owing to a faulty tap, I filled it in a temperature of about +25° Fahr., at Rimdi, near Changchenmo, in Ladak, and sent it by coolie over two passes about 18,000 feet high to Leh, and thence by parcels post to London, over three passes varying in height from 11,500 to 13,600 feet, and through India in the month of June, when it is reasonable to suppose that it was subjected to a temperature of about 100° Fahr., probably higher. This instrument, which in all probability experienced a change of temperature of about 75° Fahr., reached Dr. Norman Collie in London quite safely.

NOTE BY DR. J. NORMAN COLLIE, F.R.S., ETC.

The barometer mentioned above by Captain H. H. P. Deasy ought to be of considerable use as a field instrument, chiefly on account of the ease with which it can be packed and carried about without fear of damage. The ordinary mercurial barometer is an unwieldy instrument to use, and must be constantly looked after during transport; in this new form of mercurial barometer, the stem being flexible obviates most of the objections which can be urged against the ordinary form of barometer.

During a mountaineering expedition to the Himalayas in the summer of 1895, I first used one of these flexible-stem barometers. The instrument was packed in a quarter-pound tobacco-tin, and usually carried in the pocket of my coat; for a scale a pocket steel measure was used, and my ice-axe, and two indiarubber rings to clamp the barometer on to the axe, served as a support for the instrument. Of course the readings were only approximately accurate to within, perhaps, a tenth of an inch, and do not for one moment compare with those obtained by the perfected instrument used by Captain Deasy. The instrument, however, has lasted well. Since 1895 it has been lying about in a cupboard, but it is still in a perfectly usable condition, and I shall take it with me on an expedition this summer to the Selkirks, in Western Canada.

Appended is a table of comparisons of two patent portable barometers with two standard barometers.

HEIGHT IN MILLIMETRES.

Barometers.	I.	II.	III.	IV.
June 11, 1897	767·6 ...	767·4 ...	767·3 ...	767·4
June 12, 1897	767·5 ...	767·4 ...	767·2 ...	767·4

I. Barometer at University College (chemical laboratory).
II. Barometer at Pharmaceutical Society (chemical laboratory).
III. Barometer used during trip to Tibet, 1896.
IV. Barometer used in Himalayas (Kashmir), 1895.

NOTE.—There was a minute bubble of air in Barometer III. Barometers II., III., and IV., were all read in the same room, which was about 30 feet higher than the room at University College in which Barometer I. was read.

THE SOCIETY'S ADDRESS TO THE QUEEN.

WE give in this month's number of the *Journal* a reduced facsimile of the Address presented to the Queen, on the occasion of the completion of the sixtieth year of Her Majesty's reign. Necessarily the colour embellishments are omitted.

1837
1897
TO HER MOST EXCELLENT MAJESTY
THE QUEEN EMPRESS
The Humble Address of the President and Council of the Royal Geographical Society.
Most Gracious Sovereign,
We, Your Majesty's dutiful and loyal subjects, the President and Council of the Royal Geographical Society, beg leave, most respectfully, to offer in the name of the Society, our sincere congratulations on the completion of the Sixtieth Year of Your Majesty's happy and glorious reign.
Sixty Years ago, on the accession of Your Majesty's accession, our predecessors presented Your Majesty a humble address, thanking you for your gracious condescension and munificence in granting the Society the honour of Your Royal Patronage and in bestowing upon the Society a Royal Premium for the encouragement of geographical science and discovery.
Your Majesty has been graciously pleased to continue these marks of Your Royal favour throughout your long reign much to the advantage of the Society and to the advancement of the important subject with which it is its function to deal. The most distinguished explorers & geographers at home and abroad during that long period have been the recipients of the Medal which Your Majesty's liberality enables the Society to award each year.
In the humble address offered by the Society sixty years ago it was predicted that the reign of Your Majesty, like that of your great predecessor Queen Elizabeth would be famed for its glory and prosperity, and for the promotion of geographical knowledge. This prediction has been amply fulfilled, for during Your Majesty's reign, all the unknown lands of the earth have been opened up, the depths of the ocean have been explored, and both poles have been closely approached, and that to a large extent by British enterprise.
Through this means not only has knowledge been greatly advanced, but humanity has been materially benefited, civilisation spread over the globe, and the glory of the great Empire over which Your Majesty reigns, enhanced in a degree never before equalled.
That Your Majesty may still be long spared to reign over this Great Empire is the earnest wish and ardent prayer of Your Majesty's loyal and devoted servants and subjects the President, Council and Fellows of the Royal Geographical Society.
President
June 21st 1897
T. MORING, LONDON. W.C.

REDUCED FACSIMILE OF THE ADDRESS PRESENTED TO THE QUEEN BY THE ROYAL GEOGRAPHICAL SOCIETY.

reached me when I was on my way to Tibet, having proved defective owing to a faulty tap, I filled it in a temperature of about +25° Fahr., at Rimdi, near Changchenmo, in Ladak, and sent it by coolie over two passes about 18,000 feet high to Leh, and thence by parcels post to London, over three passes varying in height from 11,500 to 13,600 feet, and through India in the month of June, when it is reasonable to suppose that it was subjected to a temperature of about 100° Fahr., probably higher. This instrument, which in all probability experienced a change of temperature of about 75° Fahr., reached Dr. Norman Collie in London quite safely.

NOTE BY DR. J. NORMAN COLLIE, F.R.S., ETC.

The barometer mentioned above by Captain H. H. P. Deasy ought to be of considerable use as a field instrument, chiefly on account of the ease with which it can be packed and carried about without fear of damage. The ordinary mercurial barometer is an unwieldy instrument to use, and must be constantly looked after during transport; in this new form of mercurial barometer, the stem being flexible obviates most of the objections which can be urged against the ordinary form of barometer.

During a mountaineering expedition to the Himalayas in the summer of 1895, I first used one of these flexible-stem barometers. The instrument was packed in a quarter-pound tobacco-tin, and usually carried in the pocket of my coat; for a scale a pocket steel measure was used, and my ice-axe, and two indiarubber rings to clamp the barometer on to the axe, served as a support for the instrument. Of course the readings were only approximately accurate to within, perhaps, a tenth of an inch, and do not for one moment compare with those obtained by the perfected instrument used by Captain Deasy. The instrument, however, has lasted well. Since 1895 it has been lying about in a cupboard, but it is still in a perfectly usable condition, and I shall take it with me on an expedition this summer to the Selkirks, in Western Canada.

Appended is a table of comparisons of two patent portable barometers with two standard barometers.

HEIGHT IN MILLIMETRES.

Barometers.	I.	II.	III.	IV.
June 11, 1897	767·6 ...	767·4 ...	767·3 ...	767·4
June 12, 1897	767·3 ...	767·4 ...	767·2 ...	767·4

I. Barometer at University College (chemical laboratory).
II. Barometer at Pharmaceutical Society (chemical laboratory).
III. Barometer used during trip to Tibet, 1896.
IV. Barometer used in Himalayas (Kashmir), 1895.

NOTE.—There was a minute bubble of air in Barometer III. Barometers II., III., and IV., were all read in the same room, which was about 30 feet higher than the room at University College in which Barometer I. was read.

THE SOCIETY'S ADDRESS TO THE QUEEN.

WE give in this month's number of the *Journal* a reduced facsimile of the Address presented to the Queen, on the occasion of the completion of the sixtieth year of Her Majesty's reign. Necessarily the colour embellishments are omitted.

1837
1897
TO HER MOST EXCELLENT MAJESTY
THE QUEEN EMPRESS
The Humble Address of the President and Council of the Royal Geographical Society.
Most Gracious Sovereign.
We, Your Majesty's dutiful and loyal subjects, the President and Council of the Royal Geographical Society, beg leave, most respectfully, to offer in the name of the Society, our sincere congratulations on the completion of the Sixtieth Year of Your Majesty's happy and glorious reign.
Sixty Years ago, on the occasion of Your Majesty's accession, our predecessors presented Your Majesty a humble address, thanking you for your gracious condescension and munificence in granting the Society the honour of Your Royal Patronage and in bestowing upon the Society a Royal Premium for the encouragement of geographical science and discovery.
Your Majesty has been graciously pleased to continue these marks of Your Royal favour throughout your long reign much to the advantage of the Society and to the advancement of the important subject with which it is its function to deal. The most distinguished explorers & geographers at home and abroad during that long period have been the recipients of the Medal which Your Majesty's liberality enables the Society to award each year.
In the humble address offered by the Society sixty years ago it was predicted that the reign of Your Majesty, like that of your great predecessor Queen Elizabeth would be famed for its glory and prosperity, and for the promotion of geographical knowledge. This prediction has been amply fulfilled, for during Your Majesty's reign, all the unknown lands of the earth have been opened up, the depths of the ocean have been explored, and both poles have been closely approached, and that to a large extent by British enterprise.
Through this means not only has knowledge been greatly advanced, but humanity has been materially benefited, civilisation spread over the globe, and the glory of the great Empire over which Your Majesty reigns, enhanced in a degree never before equalled.
That Your Majesty may still be long spared to reign over this Great Empire is the earnest wish and ardent prayer of Your Majesty's loyal and devoted servants and subjects the President Council and Fellows of the Royal Geographical Society.
President
June 21st 1897
T. MORING, LONDON, W.C.

REDUCED FACSIMILE OF THE ADDRESS PRESENTED TO THE QUEEN BY THE ROYAL GEOGRAPHICAL SOCIETY.

THE MONTHLY RECORD.

EUROPE.

National Photographic Record Association.—Sir J. Benjamin Stone, M.P., who has greatly interested himself in the systematic collection of photographs illustrating the history of different parts of the country, convened a meeting on July 8 to consider the further development of the idea. To this meeting he invited, amongst others, representatives of the Royal Society, the Royal Geographical Society (Major Darwin and Dr. Mill), the Society of Antiquaries, the Royal Archæological Institute, the Royal Institute of British Architects, the Royal Photographic Society, the British Museum, and the South Kensington Museum. Sir Benjamin Stone presided, and spoke of the important aid to historical description which the modern permanent photographic processes had rendered available. It was now possible to secure photographs which were as durable as the paper on which they were printed, and the British Museum authorities had undertaken to accommodate a collection forming a National Record as soon as it was brought together. The chairman had presented one hundred pictures of Westminster Abbey and the Houses of Parliament, which he had taken himself, to form a nucleus. During a short discussion, the importance of making the proposed record applicable to the whole United Kingdom, and of making it include illustrations of the common dwellings of the people as well as public buildings and objects of archæological interest, was insisted on. A resolution was put and carried that an association should be founded for the purpose of carrying out the proposed plan under the name of the National Photographic Record Association, and a small committee was nominated to carry out the organization of the association. The names proposed were the Earl of Crawford, F.R.S., Sir E. Maunde Thompson, Sir Benjamin Stone, M.P., Prof. Meldola, F.R.S., Captain Abney, F.R.S., Dr. H. R. Mill, Mr. Alexander Graham, Mr. St. John Hope, Mr. Philip Norman, Mr. W. W. Watts, Mr. C. E. Fagan, Mr. Lawrence, and Mr. Robinson, while Mr. Scamell, Hon. Secretary of the Royal Photographic Society, agreed for the present to act as secretary. The exact scope of the work of the new association has not yet been defined; but there is no doubt that it will be to a very large extent geographical in its character, and will help towards the more complete description of the British Islands.

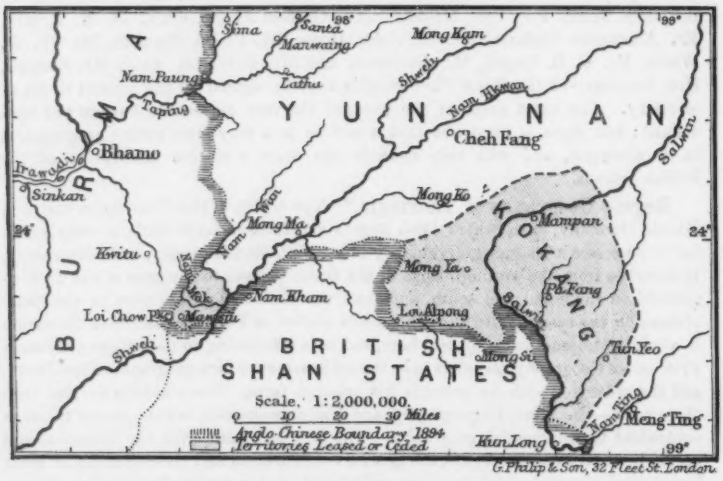
Regel's Geography of Thuringia.*—The region of the Thuringian states in Middle Germany, with which Prof. Regel's voluminous book deals, is very small, but it possesses a distinct individuality physically, ethnologically, and historically. It stretches from the southern slope of the Hartz plateau to the crest of the Thüringerwald on the north and south, and from the Eichsfeld on the west to the Saale plateau on the east. With the conclusions arrived at from the elaborate discussion it would be impracticable to deal here, but it is interesting to note what a German Professor of Geography considers to be the subject-matter for a geographical handbook, and the order in which he presents his selected facts. The whole is divided into three parts—the Land, Biogeography, and *Kulturgeographie*, which may be taken as equivalent to commercial geography. The first part deals with the historical and actual boundaries of the region, the general configuration and river-systems, at great length with the geological structure and history, and more briefly with the climate. The second part forms two great divisions—the first dealing very exhaustively with

* 'Thüringen: Ein geographisches Handbuch.' Von Dr. Fritz Regel. 3 vols. Jena: Gustav Fischer. 1892-96.

the distribution of plants and animals, including long lists of species; the second treating of the inhabitants. The portion dealing with the people occupies one quarter of the whole work, and includes a discussion of the prehistoric inhabitants, an account of the people inhabiting the country throughout historical time (practically an epitome of the history of Thuringia), an anthropological study of the existing inhabitants, and discussions on the local dialects, folk-lore, costume, and dwellings. The third great division treats of the utilization of the land in agriculture, cattle-rearing, forestry, fishing, and mining, the industries (treated in much detail), trade, the distribution of the people, and, more briefly, the religious, intellectual, and political conditions. The whole work is minutely classified, and the divisions numbered. A valuable subject-index, with about twenty thousand references, concludes the whole. Each section is headed with a list of the literature of the subject, and nothing more elaborate and exhaustive could well be imagined. We miss, however, a general summary, which might combine and generalize the bewildering profusion of facts and figures. The illustrations have suffered from the necessity of keeping down the cost of production, but, in spite of all economy, the work must have been an expensive one to produce, and the publishers, no less than the author, deserve praise for their enterprise in carrying it to a conclusion. A geological map, printed in black alone, but clearly indicating twenty-six different formations, is a marvel of skilful draughtsmanship.

ASIA.

The Anglo-Chinese Agreement of June 5, 1897.—The Anglo-Chinese Agreement, which was ratified at Peking on June 5 of the present year, very considerably modifies the stipulations of the Frontier and Trade Convention of March 1, 1894. These modifications had become necessary in consequence of China having



alienated, by her Convention of June 20, 1895, with France, certain territories which she had undertaken not to cede to a third power without having previously obtained the consent of Great Britain. China, notwithstanding this clear understanding, ceded the small state of Muang U, in the upper valley of the Nam U, and

the state of Kiang (Keng) Hung to the east of the upper Mekong. By the present agreement full reparation is made for this breach of the convention of 1894. Articles II. and III. deal with territorial changes. By Article II., China grants to Great Britain a perpetual lease of a small territory to the west of the Shweli river, which is bounded on the north by the Nam-Wan, and traversed by the Nam Mak. This territory possesses some importance, as it presents facilities for building a road from Bhamo by way of Kwitu to the Shweli. The administration and control of this district will be entirely conducted by the British Government, China undertaking not to exercise any jurisdiction or authority whatever. By Article III., China cedes the Shan state of Kokang, which lies for the greater part beyond the Salwin, its chief if not only access being along the railway now under construction between Mandalay and the Salwin ferry at Kun Long. Commercially, the concessions made are even more important. Trade between Burma and Yun-nan, which had been confined to the routes leading to the Chinese custom-houses at Sansi (25° 7′ N.) and Manwaing (Manwyne, 24° 32′ N.), is to be sanctioned by any other routes, the opening of which may be found to be in the interests of trade. The question of the construction of railways in Yun-nan is to be considered, and if decided in the affirmative these lines are to be connected with those of British Burma. By Article XIII., Great Britain may station consuls at Sumao, in Southern Yun-nan, and either at Momein (Tung-Yueh-ting, 25° N.), or Shun-ning-fu, on the upper Mekong (24° 25′ N.), and British subjects may establish themselves and trade at these places under the same conditions as at the treaty ports. Lastly, China has consented to the opening of the West river or Si-kiang as far as Wu-chau-fu, about 180 miles above Canton, where the tide still rises from 12 to 20 feet. The town named Sam-shiu and Kong-kun are to be "open" ports, and steamers will also be allowed to call at Kong-mun, Kom-chuk, Shin-ning, and Tak-hing for goods and passengers. Our sketch-map is intended to illustrate the territorial changes effected by this agreement. As the country beyond the Salwin is still almost a *terra incognita*, the boundaries given to Kokang must be accepted as a rough approximation. Its survey will no doubt be undertaken shortly. As to the Si-kiang, it is interesting to note that H.M.S. *Tweed* has already left London for the purpose of making a survey as far as Wu-chau.

Dr. Sven Hedin's Travels.—Pending the presentation to the Society of the connected narrative of his travels, which Dr. Hedin has promised for one of the evening meetings next session, it may be of interest to recall in outline the chief explorations carried out by him during his long wanderings in the heart of Asia. After a preliminary journey to Persia and Kashgar in 1890, Dr. Hedin returned to Sweden and obtained the support of King Oscar and one or two private individuals for an exploring project, by which he proposed to visit some of the least-known districts of Central Asia. He set out in October, 1893, and spent the greater part of 1894 in investigations of the climate and glaciers of the Pamirs, paying particular attention to the relation of the snow to the quantity of water in the tributaries of the Amu-darya. He ascended the great peak of Mus-tag-ata (Tagarma) to a height of 20,000 feet, out of its total of 25,000. The succeeding winter was spent at Kashgar, and in February, 1895, Dr. Hedin started eastward, exploring the country between the Kashgar and Yarkand rivers, and proceeding in April to cross the dreaded Takla-Makan desert, between the latter river and that of Khotan. Its passage had never before been attempted, and though successful, Dr. Hedin barely escaped with his life, the caravan finding no water during a thirteen days' march across a desolate region of high sand-dunes. In addition to the leader, only two men and one camel reached the Khotan river. Whilst waiting to replenish his supplies, and to replace the instruments lost on this unfortunate expedition, Dr.

Hedin paid another visit to the Pamirs, and completed his topographical and geological survey of the difficult mountain ranges which bound them to the east. Leaving Kashgar again in December, 1895, he proceeded to Khotan, crossed the desert between the Khotan and Keria rivers, and traced the latter to its termination in the sands. He then crossed the desert northwards to the Tarim, discovering interesting remains of old buried cities, once possessed of a high degree of culture. Continuing down the Tarim, he carefully mapped its intricate river-system, and proceeded to Lob Nor, where he set himself to solve the problem of the discrepancy between Prjevalsky's account of the lake and its delineation on old Chinese maps. Dr. Hedin found the large northern lake of the latter represented by a series of small lakes in a part of the Gobi unvisited by travellers. In May, 1896, he was again in Khotan, and a month later set out for Tibet, crossing the Kwen-lun by a new pass south of the Kopa goldfields (about 82° E.). For two months he journeyed across the northern, highest plateau of Tibet, seeing not a single human being outside his own party, but finding great herds of wild horses and yaks. Four large and nineteen small salt lakes were discovered, the largest stretching alongside the route during four days' march. Having lost many of the baggage animals, the caravan made for Tsaidam, the first Mongols being met at Tsohan-gol. In Tsaidam the party had to stand on their guard against the attacks of Tangut robbers, but eventually avoided a fight. Passing through Sining and Liang-chau, Dr. Hedin crossed the Alashan desert by a new route, and made his way through the Ordos country to Peking, which was reached on March 2, 1897. He returned to Europe *viâ* Urga and the Siberian railway. As already mentioned, Dr. Hedin is now engaged in writing the narrative of his travels, and will for some time to come be occupied with the working-up of the scientific results.

Exploration of Bukhara.—An expedition, under Colonel Kouznetsoff, was sent out this spring from Russian Turkistan for the exploration of Bukhara. Part of this expedition has already returned home. From the railway station, Kermineh, they went southwards *viâ* Karshi, Guzar, and Shir-abad, to the ruins of Termez. They collected chiefly statistical information, and studied the economic conditions of the Khanate. From Termez they reached the banks of the Amu at Pata-ghissar, and followed them for 190 miles, through the desert region, crossing the Surkhan, Kafirnagan, and Vaksh rivers, and finding on this stretch only two inhabited spots, Aivaj and Sarai. From this first spot they explored the yet unknown region in the direction of Chubek and Sarigor, whence they returned to Aivaj, and from this spot proceeded down the Amu to Charjui in a boat. More than two hundred photographs were taken during the journey. It is to be hoped that through the expedition we shall at last learn something about the population and economic life of Bukhara, which hitherto remain less known than even far less accessible parts of Central Asia.

Attack on Lieut. Pottinger's Expedition to the Upper Irawadi.—We regret to learn that the expedition under Lieut. Eldred Pottinger to the upper Irawadi, which was supported by the Royal Geographical Society, met with a reverse at the end of May last. According to telegrams received in June, an attack was made by the "Black Mairus" on the night of May 22, and a native surveyor and one of the Gurkhas of the party were killed. The leader escaped, with his companion Mr. Laurence and the rest of his force, and after great difficulties reached Myitkyina, below the junction of the two branches of the Irawadi, on June 18. Lieut. Pottinger informs us by letter that he has been able to save his maps, which will throw light on the previously unknown country between 25° 20′ and 26° 45′ N., and between 98° 15′ and 98° 45′ E. He promises the full account of his travels shortly.

The Chin Hills.—We have received from the Chief Commissioner of Burma the first volume of a comprehensive account of the Chin hills, which is being brought out under Government auspices by R. S. Carey and H. N. Tuck. Besides giving a historical sketch of the British relations with the Chins, it contains a useful summary of the geography of the country and the manners and customs of the inhabitants. The abundant photographic illustrations are also a valuable feature. The country is described as consisting of a much broken and contorted mass of mountains intersected by deep valleys. It is utterly devoid of plains and tablelands. The main ranges run generally north and south, varying from 5000 to 9000 feet. Five distinct kinds of forest are mentioned, but the hills are often thickly clothed with grass. The illustration facing page 5 gives a typical view of the nature of the country. Of the Chin tribes, the Hakas of the south contrast strongly with the Siyins of the north by their manly carriage and frank manner. The latter are cruel and untrustworthy. Three types of village are described—those of the nomadic "jhoomers," the professional raiders, and the stationary communities, powerful enough to resist attack. The raiders choose the most inaccessible sites, without thought of other advantages. Those of the third class are also carefully fortified, and the entrances are so small as to admit only one man at a time. They are nearly always placed on the side of the hills. Numerous illustrations of villages and houses are given, plate 17 (*a* and *b*) showing the great size to which the former sometimes attain. The system of bachelor quarters which prevails among many of the hill tribes between Burma and Assam, does not appear to be found amongst the Chins. Amongst the Hakas, whose houses are the finest in the hills, the back room is occupied by the whole household, the girls sleeping on one side, and their would-be sweethearts on the other. Marriage customs differ in the north and south, but in both the girls are practically sold by their parents.

The Amur Geographical Society.—The last issue of the 'Memoirs' (*Zapiski*) of this young Society (vol. ii. part i.) contains a very interesting work, by M. Shimkevich, on Shamanism amongst the Golds. It is a well-written account of the religion of this interesting tribe, its customs, beliefs, etc., in which some quite new folk-lore is given. Portraits of shamans, and photographs of many interesting objects of worship are given. The second part of the same volume is devoted to an inquiry, by N. A. Krukoff, into the forms of land-ownership, which have been worked out by different Russian settlers in the Amur and the Usuri regions, on the lands which were allotted to separate villages.

AFRICA.

British Expedition to the Jub.—Major J. R. L. Macdonald, well known for his work in British East Africa, left England in June last to take command of an expedition despatched by the British Government to explore the river Jub. One of the main objects of the expedition is to settle which is the main branch of the stream, this constituting the boundary of British East Africa according to the Anglo-Italian agreements of 1891 and 1894. On some maps, published both abroad and at home, the frontier is shown as following the course of the Daua, although this would seem rather to be a southern tributary of the main stream. King Menelik is said to be desirous of coming to an understanding with the British Government with regard to the mutual frontier. It will be remembered that Dr. Donaldson Smith holds to the belief in the identity of the Omo with the Jub, so that, in spite of the many Italian expeditions to this region, some important geographical work remains for Major Macdonald to perform. He will be accompanied by various officers, with a force of Indian troops, and it is hoped that a large increase to our knowledge of the country in various directions will result.

M. Foa's Explorations in the Zambezi-Nyasa Region.—M. Foa calls our attention to the scientific results of his travels, the narrative of which has lately been given to the public in the works noticed elsewhere in the *Journal*. M. Foa's journey was carried out under the instructions of the French *Ministre de l'Instruction Publique*, and the large zoological collections made by him have been sent to the Paris Museum. Throughout his journeys, largely over untraversed routes, M. Foa executed surveys checked by astronomical observations. He visited the old gold-workings north of Zambezi, and carried out a triangulation of them with the aid of the theodolite. He also investigated the hydrography of the country between the Zambezi and Lake Nyasa, and determined the watershed between the two systems. The results of these surveys are unfortunately not fully given in the published account of his travels, and M. Foa does not inform us in what form they are to be issued. In May last he was about to start from the Shire river on a new expedition to Lake Tanganyika, whence he hoped to proceed by new routes to Katanga, and possibly to make his way across to the French Congo territory.

Dr. Esser's Exploration of the Lower Kunene.—The second number of the *Verhandlungen* of the Berlin Geographical Society for the current year contains the account of a journey made by Dr. Max Esser to the district of the lower Kunene, principally with a view to testing the possibilities of the stream as a means of communication with the interior of German South-West Africa. Starting from Mossamedes, Dr. Esser proceeded southward to Port Alexander, an excellent harbour, which, in spite of the absence of good drinking-water, might acquire importance from the export of dried fish, used along the whole West African coast as the staple food of the negro labourers. Hence the route led over the Chella range and down the Caculovar to the Kunene, which was then followed to the sea. Great quantities of game, including elephants, giraffes, and ostriches, were met with throughout most of the journey. On the west of the Chella range, a nomadic people, the Muquichs, were encountered. They are served by the Ba Kubabe, one of the rudest and least civilized tribes to be found in Africa, whose whole nutriment consists of raw roots and leaves. Fires were never seen in their villages. East of the Chella, the Nyi Buba, a branch of the Vaherero of Damaraland, formed a complete contrast by their intelligence and noble bearing. Many Boers were met with, some being engaged in washing for gold, which has lately been discovered in rich deposits north-east of Humbe. The Kunene varies exceedingly in character, being sometimes broad and fordable, and sometimes confined to a rocky channel less than 10 yards wide. In the direction of the sea the country became more and more broken and rocky, the colouring of the rocks defying reproduction on paper. Below the St. Marien, a tributary on the south bank, the stream appeared to be navigable to within a little of its mouth, none of the obstructions marked on Portuguese maps being visible. Dr. Esser saw evidences of the former existence of a channel leading southwards to a small bay, which, he considers, may supply a means of approach to the coast for ships. The main mouth of the river being, as is known, blocked by drift-sand, this bay may, he thinks, become an important point of entry into the German territory, the Kunene route having the advantage of a constant water-supply. Tiger bay, north of the Kunene, is, however, considered by Dr. Esser as the best harbour on the whole coast, and the natural terminus of a railway which might connect the Atlantic and Indian oceans *viâ* British South Africa and the Transvaal.

Dr. Passarge's Expedition in South Africa.—Dr. S. Passarge, well known for his explorations in Adamawa, last year undertook an expedition to the region of Lake Ngami. A letter from him, written in December last on the banks of the Botletli river, and published in the *Verhandlungen* of the Berlin Geographical

Society, gives some details as to the complicated *régime* of the rivers in that region. At the point at which his camp was pitched, a stream entered the Botletli from the north-west, coming apparently from the Okavango. Between the point of junction and Lake Ngami there was no perceptible current, while the eastward flow of the Botletli, east of the junction, was unmistakable. Dr. Passarge therefore suggests that the stream from the north-west, which is not shown on our maps, may date from recent years only, and that this may explain the great decrease in the size of Lake Ngami. It may be noted, however, that, ever since Livingstone's time, a branch of the Okavango has been reported as entering the Botletli direct, but this may be farther west than the stream seen by Dr. Passarge.

French Explorers in Africa.—The July number of the *Revue Française* gives several items of news relating to French explorers in Africa. M. Foureau, who set out in April last on a new journey in the Sahara, has returned to Biskra, having been unable for want of camels to proceed southwards to Aïr. The Hoggar Tuareg were raiding towards the south, and it is possible that the reverse lately sustained by a French force north of Timbuktu may have been inflicted by them. Mgr. Toulotte, of the White Fathers, has made his way from Timbuktu to Konakri by way of the sources of the Niger, passing along the frontiers of Liberia and Sierra Leone. M. Gentil, engaged in the transport of a small steamer to the Shari, has been delayed in launching the same on the Nana through the discovery of an obstruction to navigation. A suitable spot for putting together the sections was, however, ultimately found, and it is probable that the steamer was ready for launching early in May. A letter from the explorer himself, published in the *Politique Coloniale* of July 17, states that the Nana is not identical with the Kuma, as thought by Maistre, but has a parallel course.

Capture of Rejaf by Congo State Troops.—News has been received in Brussels of the capture, after severe fighting, of the post of Rejaf, in the so-called "Lado Enclave" (leased to King Leopold by Great Britain), by the expedition despatched in December last under Captain Chaltin. After being driven from their position, the Dervishes fled towards the north, and the people of the district made their submission to the Congo State. The site of the old post of Lado is now covered with brushwood, and others of the old Egyptian stations have also ceased to exist.

AMERICA.

Cabot Celebrations.—A meeting of the Royal Society of Canada was held in June to commemorate the discovery of the continent of North America by John Cabot. Major-General D. R. Cameron was present as delegate of the Royal Geographical Society, and on behalf of that body delivered a message of sympathy with the objects of the gathering, and appreciation of the invitation given to the Society to send a representative to it. The reception accorded to Major-General Cameron was of the heartiest nature. Exhaustive papers, dealing with Cabot's discovery and elucidating difficult points connected with it, were read by competent authorities, those by Archbishop O'Brien (President of the Royal Society of Canada) and Dr. S. E. Dawson being especially mentioned by our delegate. The former explained certain difficulties by supposing that a part of the original map of Cabot's voyage was erroneously introduced into the later and more general map. The city of Bristol is commemorating the four hundredth anniversary of Cabot's voyage by the erection of a memorial tower, intended to be 100 feet high, the foundation stone of which was laid by Lord Dufferin on June 24. The tower will be squarely built, in two stages, with an octagonal spire surmounted by a globe and symbolical figure. Lord Dufferin delivered an address, in which he pointed out the importance of Cabot's

discovery to the development of the sea-power of Great Britain. At Halifax, Nova Scotia, a memorial tablet was on the same day unveiled by the Governor-General of Canada, whilst the occasion has been commemorated by the Newfoundland Government by a special issue of postage stamps.

Scientific Expeditions in North America.—The various scientific expeditions now in the field in one part or another of North America include two to Mount St. Elias—one Italian under Prince Luigi Amadio, and one American under Mr. Henry G. Bryant, well known as the leader of the Peary Auxiliary Expedition of 1894. Prof. W. Libbey, jun., also a member of the same expedition, has proceeded with a party of explorers to Albuquerque, New Mexico, with the intention of exploring a *mesa* or sandstone tableland in that neighbourhood, which has hitherto proved inaccessible, although it is thought to contain archæological remains. Its height is more than 7000 feet. It is also announced that a party from the London Alpine Club and the Boston Appalachian Mountain Club will carry out explorations in the Canadian Alps, whilst the islands in the Gulf of California are to be explored by an expedition sent out by Mr. Jesse D. Grant. The anthropological study of the North Pacific, set on foot by M. K. Jessop, has already been alluded to (*Journal*, vol. ix. p. 568).

Rainfall of the Northern Part of Central America.—By way of completing the work of Prof. M. W. Harrington on the Central American Rainfall (Washington, 1895), and correcting it on the basis of further data, Dr. Karl Sapper, of Coban, Guatemala, contributes to the June number of *Petermanns Mitteilungen* some notes on the rainfall of Guatemala, Salvador, British Honduras, and the southern parts of Mexico as far as the Isthmus of Tehuantepec, and annexes three rainfall maps. The data are, however, still very imperfect. The maps are based on observations at thirty-three stations, but only at six of these do the observations extend over more than four years. In the part of Mexico included, for the omission of which from Prof. Harrington's work Dr. Sapper expresses regret, there are only three stations, with observations for one year each, and those different years. Dr. Sapper has, thus far vainly, endeavoured to obtain the results of the meteorological observations at Campeche and Mérida—for a series of years presumably, for Mérida is one of the places for which in his table he gives data for one year. The two other Mexican stations are Ixtacomitan and San Juan Bautista. The inadequacy of the data thus afforded has compelled him to base his map, so far as Mexico is concerned, on the character of the vegetation.

The Chilian-Argentine Boundary Question.—The voluminous nature of the literature on the question of the boundary between Chili and Argentina, and the plausible advocacy by writers on the one or the other side of the particular view which favours their own nation, renders the clear and impartial review of the whole question by Dr. Steffen, in the *Zeitschrift* of the Berlin Geographical Society (1897, No. 1, with map), of special value to those who have not the time or opportunity to search through the mass of original documents which bear on the subject. Copious references to these are given in the course of the article, while Dr. Steffen's personal acquaintance with a portion of the region in dispute, from his well-known journeys between 1892 and 1896, makes him well qualified for the task he has undertaken. The first section of the paper takes us back to the days of the Spanish colonies in South America, and discusses the somewhat doubtful question of the limits between the captain-generalcies of Chili and La Plata. This, as Dr. Steffen points out, is now of merely historical interest, since the dispute was placed on an entirely new footing by the agreement of 1881, according to which Chili abandoned all claims arising from historical considerations in the southern extremity of the continent, and allowed the decision to depend on natural principles connected with

physical geography. Since that date the difficulties in the way of a settlement have arisen from the ambiguities in the terms of the agreement of 1881, which laid down, as the boundary between the extreme north and 52° S. lat., a line passing through "the highest summits of the Andes, which form the water-parting" (*cumbres mas elevadas que dividan las aguas*), whereas the line of highest summits by no means necessarily coincides with the water-parting. Other ambiguities appear in the clauses dealing with the boundary beyond 52° S. lat., but these have been partially removed by subsequent agreements. The main source of disagreement was rather emphasized than removed by the protocol of 1893, which, while adhering to the faulty formula as the absolute rule for the determination of disputed points, introduced the inconsistent, and in itself far from precise, expression *encadenamiento principal de los Andes* ("principal chain of the Andes") to describe the line chosen. This agreement of 1893 is, in fact, in many ways the least practical of all. That of 1896 is principally important for its definite adoption of the principle of arbitration (*Journal*, vol. viii. p. 640). The third part of the paper describes the progress which has been made with the actual demarcation of the boundary, which presents comparatively few difficulties as regards the northern and central portions.* In the last section of his paper, Dr. Steffen describes the principal passes and chains of the Andes in the region explored by him personally (between 40° and 44° S. lat.), pointing out the principal sections in which the main chain deviates from the water-parting, and the districts which are thus still in dispute between the two powers. The upper basin of the Puelo, known as "El Valle Nuevo," now occupied by Argentina, would, in case the line of the water-parting were upheld, fall to Chili, as would also the "Valle seis de Octubre," in about 43° S. lat., where an Argentine colony has been established by Colonel Fontana.

Proposed Survey of Chili.—We have received from the author a pamphlet by Dr. Paul Krüger, professor in the University of Valparaiso, setting forth a scheme for the trigonometrical survey of Chili. The difficulties presented by the country are in many ways unusually great, but we are glad to learn that there is some prospect of the work being undertaken on an adequate scale.

Dr. Herrmann Meyer's Journey to the Headwaters of the Xingu.—From the account of Dr. Meyer's journey, published by the Berlin Geographical Society (*Verhandlungen*, 1897, No. 3), we take the following details, which supplement those previously given in our pages (*Journal*, vol. ix. p. 449). It appears that the Ronuro, which Dr. Meyer considers the main headstream of the Xingu, was not followed throughout from its source, the guide insisting on taking the party by way of the Jatoba, a right-bank tributary of the former. Near its source this stream was hemmed in by steep clay banks, behind which stretched hills clothed with dense thorny bush. Numberless falls and rapids broke the course of the river, causing great difficulties in its navigation. No fewer than 105 were counted, apart from the smaller rapids. The loss of supplies caused by accidents to the canoes placed the travellers in a precarious position; but, fortunately, a fishing-place of Indians from the Batovy (the stream explored by Von den Steinen) was met with, and food obtained from them. The banks of the stream, after the hilly country had been passed, were covered with a thick matted forest, with no sign of permanent habitation. Eight days after meeting with the Indians, the Ronuro was reached, and the broad and deep stream offered no more hindrance to navigation, while the abundance of fish provided an ample food-supply. Animal

* The disputed point with reference to the Puna de Atacama (*Journal*, *loc. cit.*) is but lightly touched upon by Dr. Steffen, who avowedly devotes his chief attention to Patagonia.

life seems to have been generally more varied than before. An important stream, emptying itself into the Ronuro from the west, was discovered, and Dr. Meyer thinks that it may be derived from certain headstreams previously attributed to the Paranatinga (Tapajos basin). Traces of Indians were now met with, but none were seen until near the junction of the Ronuro with the Kuluene (the eastern headstream of the Xingu). Here a party of Kamayura were met with, being the first really wild Indians with whom the expedition had come in contact. Friendly relations were established with them, and also with the Trumai, who live on the Kuluene. This tribe appears to be rapidly diminishing in numbers, and to stand at a lower grade of civilization than the Kamayura. On the return journey, the Nabuqua, a previously unvisited tribe dwelling between the Kuluene and Kulisehu, were reached by a land excursion, the travellers then striking across to the upper Kuluene, a stream with a powerful current, but decidedly smaller than the Ronuro. It was descended to its junction with the Kulisehu, by which stream the return voyage was effected.

M. Coudreau's Expedition to the Xingu.—The *Revue Française* publishes news of M. Coudreau's expedition (*Journal*, vol. ix. p. 93), according to which the French traveller had succeeded in reaching the upper river, but had been twice attacked by native tribes, several members of his expedition being killed and wounded. Eighty-three rapids had been passed. Numerous colonists were met with on the lower river, and a number of Indian tribes were visited. Caoutchouc abounds in various parts of the Xingu basin.

AUSTRALASIA.

Journeys in Western Australia.—On March 1, 1896, a prospecting party composed of six persons with thirty horses started from Cue, the centre of the Murchison goldfield in Western Australia, in 27° 25′ S., 117° 52′ E., under the leadership of Mr. H. Fletcher. Proceeding in a north-north-easterly direction, the party reached the east end of the Ophthalmia range, in 23° 17′ S., 119° 35′ E., and then advancing north-eastwards across the Fortescue range, were three days without water. At last, about 60 miles east of the Oakover river (one of the headstreams of the De Grey), they discovered a hitherto unknown but not inconsiderable river with an east-north-easterly current. This they named the Bloomer, and followed for 100 miles. In many places it had a steady flow, but it appeared as if it would dry up within six months to a series of water-holes unless heavy rains occurred. With the exception of a few stretches of better land on its course, the region traversed consisted of nothing but desert, sandstone ridges, and spinifex. In the end the river expanded into a lagoon about 2 miles long, on which were numerous ducks and other waterfowl. Kangaroos and emus also abounded. Many natives were met, of powerful build, but so shy that it was impossible to enter into communication with them. On July 15 the party returned to Nannine, a mining station 59 miles north-east of Cue. In June, 1896, Mr. H. W. Harslett undertook an expedition from Port Augusta, in South Australia, to Norseman on the Dundas goldfield, in Western Australia, with the view of finding out a practicable route for the passage of cattle between the two colonies. The route followed was nearly that of the old telegraph line, but from Ponton's station the party diverged northwards to Buldara and Norseman, arriving at the latter place on November 16. A similar attempt, but much further north, was made in the same year by Mr. S. G. Hübbe on behalf of the Department of Crown Lands in Adelaide. Setting out from Oodnadatta, the present terminus of the transcontinental railway, it struck Mr. (now Sir) John Forrest's route of 1874, and kept to it with little deviation to 125° E. It then turned to the south-west, crossed Wells's route of 1892 at Lake Wells,

and arrived at its destination, Niagara, the easternmost telegraph station of Western Australia, 1½° north of Coolgardie, after forming ninety-five camping-stations. The return journey was almost direct to Eyre's Sandpatch, and thence along the old telegraph line. The results of the topographical survey made on this journey are laid down on a map in three sheets on the scale of 1: 1,000,000, published at the Surveyor-General's Office, Adelaide, in 1896. The third sheet shows a new telegraphic connection of the mining district of Western Australia.—*Petermanns Mitteilungen*, June, 1897.

The Australian Bush and the Coasts of the Coral Sea.*—This book adds another to the rapidly increasing number of descriptive books of travel which we commonly designate as "narratives," indicating thereby that scientific or other special results are for the time left on one side, while the traveller tells the tale of his wanderings in the manner most likely to interest a popular audience. Prof. Semon says in his preface that his main object in undertaking this journey was to explore the ever-marvellous fauna of Australasia. A number of special reports on his collections have already appeared, and more are to follow, but in this volume zoology occupies only a secondary part, the narrative including many observations in the usual fields of botany, geology, ethnology, etc. The journey may be said to have begun at Maryborough in August, 1891, Gayndah being made a centre for a number of exploring excursions in the Burnett district. In the course of these Prof. Semon made extensive acquaintance with the manners and customs of the Australian bush, and received object-lessons in the art of colonization as practised by the British, which seem to have impressed him favourably in comparison with the more rigorously scientific methods adopted in most German colonies. Much of what is described in the first two hundred pages of the book is commonplace enough in this country, but it is always pleasant to see the merits and difficulties of our work appreciated. After a chapter on Australian aborigines, Prof. Semon proceeds to describe the north-east coast of Australia from Brisbane to Cape York, giving a good deal of geological information; then follows an account of Thursday island and Torres straits, and two chapters on New Guinea. The last part of the book is devoted to the East Indies, Java, Celebes, the Northern Moluccas to Amboina, and Amboina to Banda. The homeward journey through India included an expedition to Darjiling. A vocabulary of native words from the Burnett region and four indifferent maps are appended, and there are many good illustrative photographs.

Renewed Boring Experiments at Funafuti.—An expedition has been set on foot, under the auspices of the Royal Geographical Society of Australasia, to endeavour to carry to a successful issue the coral-boring experiments which last year ended in failure owing to unforeseen difficulties, arising from the honeycombed nature of the coral rock and the interspersed beds of sand met with. Liberal pecuniary assistance from private individuals in New South Wales and from the Royal Society of London, together with offers of help in other ways from the Government of New South Wales and from the London Missionary Society, have enabled the promoters to provide an ample equipment for the expedition, which started early in June under the leadership of Prof. David, one of the local members of the Royal Society's reef-boring committee. Special appliances, including pipes of various sizes to line the bore-hole, are being taken to obviate the difficulties encountered last year, the weight of the whole plant amounting to twenty-five tons. The length of pipes taken will admit of the attainment of a depth of 1000 feet, but it is

* 'Im australischen Busch und an den Küsten des Korallenmeeres: Reiserlebnisse und Beobachtungen eines Naturforschers in Australien, New Guinea, und den Molluken.' Von Richard Semon, Professor in Jena. Leipzig: Wilhelm Engelmann.

expected that the foundation of the atoll will be reached at a much less depth. Prof. David hopes to return in September.

POLAR REGIONS.

Herr Andrée's Balloon Voyage.—Favoured at last by a southerly breeze, Herr Andrée made his long-expected balloon ascent from Danes island on Sunday, July 11. The morning of that day broke with a clear sky, and, the wind blowing freshly from the south, it was decided that preparations for a start should be made. Part of the balloon-house was taken down with the greatest speed possible, and by half-past two in the afternoon all was ready for the ascent. Standing in the car with his two companions, Fraenkel and Strindberg, Andrée gave the order for the ropes to be cut, when the balloon rapidly ascended to a height of 600 feet, and, after a temporary re-descent, floated away northwards over the flat peninsula of Hollaendernaes. It continued visible to those remaining behind for about an hour, after which it disappeared in the northern horizon. Its speed was reckoned at 22 miles to the hour. The Swedish gunboat *Swensksund* returned to Tromsö on July 16 with news of the successful ascent, having encountered south-westerly winds during the passage, so that the balloon would probably take a direction towards Eastern Siberia, unless more southerly winds were encountered further north. Tidings of the adventurous travellers will be awaited with the deepest interest, but it is possible that, even if all has gone well, nothing may be heard of them for some time. Hazardous as the undertaking undoubtedly is, the excellence of the balloon, the absence of great temperature changes during the perpetual day of the arctic summer, and the great care with which every eventuality was provided for, justify some confidence in its success.

Lieut. Peary's Plans for an Expedition to the Pole.—In the February number of the *Journal* (vol. ix. p. 223) we gave the outline of Peary's proposed plan for reaching the north pole. Leave of absence for five years has now been granted to the explorer by the Navy Department at Washington, and he intends to devote the present summer to a preliminary expedition to Whale sound, on the north-west coast of Greenland, the main expedition being arranged for July of next year, before which he hopes to visit Europe. At Whale sound he hopes to make arrangements with the Eskimo, so that they may have furs and provisions in readiness on the arrival of his ship in 1898. The only civilized members of the main expedition will be Peary himself and a surgeon, the explorer believing that a greater number only diminishes the chances of success owing to difficulties of food-supply. Two scientific parties * accompany this year's expedition.

Danish Expedition to the East Coast of Greenland.—The administrators of the "Carlsberg Fund" † for scientific purposes has provided the means—150,000 crowns, or about £8300—for sending an expedition to explore a part of the east coast of Greenland, which has never before been visited, namely, the coast from Angmagsalik, about 66° lat. N., where the Danish Government a few years ago established a station, and northwards to Scoresby sound, about 72° lat. N. The leader of the expedition, Lieut. Amdrup, R.D.N., will next autumn (1898), with the steamer which the Danish Government every year sends to Angmagsalik, land here with two naturalists. The party will winter in order to reconnoitre the coast northwards and explore the tract in the vicinity of Angmagsalik, a tract of special

* A third, which was to have been headed by Prof. G. H. Barton, will, according to latest accounts, not proceed north this year.

† Carlsberg is the name of a brewery close to Copenhagen, whose proprietor, the late Mr. J. C. Jacobsen, has given a large fortune to scientific purposes.

botanical interest. The reconnoitring expedition returns to Copenhagen with the Danish steamer in the autumn of 1899, and in 1900 the real expedition, which probably will consist of two naval officers, two naturalists, and some few men to assist, will start and land somewhere at the entrance of Scoresby sound. After wintering here, the expedition will the following year (1901) proceed southwards to Angmagsalik to catch the yearly Danish Government steamer.

Sir Martin Conway in Spitsbergen.—Accompanied by Mr. E. J. Garwood, Sir Martin Conway left London on June 29 on a second expedition to Spitsbergen, with a view to continue the exploration of the interior begun last year. It is proposed to land at King's bay, on the west coast of the main island, in 79° N. lat., and to explore the inland ice-sheet thence by sledge-expeditions. Afterwards Sir M. Conway hopes to complete the exploration of the southern peninsula from Horn sound.

Hydrological Expedition to the North Siberian Sea.—An expedition which is sure to enrich our knowledge of the arctic seas, has just been sent out by the Russian government, under Rear-Admiral Makaroff, the well-known explorer of the Northern Pacific. The Russian admiral will take under his orders, at Vardö, seven steamers which have cargoes of coal and various goods for the mouths of the Siberian rivers, the Ob and the Yenisei, and he will proceed himself, on board one of these steamers, *viâ* the Kara sea, in order to ascertain how far his ideas as to the possibility of extending the period of navigation across that sea are correct. These steamers have their stems built of thick iron, and, without being ice-breakers in the true sense of the word, they can be used for breaking through the ice to some extent. The flotilla will return to Europe with various Siberian cargoes, while Admiral Makaroff intends to steam up the Yenisei and to return by the overland route. He takes with him all the hydrological and meteorological instruments with which measurements were made on board the *Vityaz* during her cruise in the Pacific. Captain Wiggins does not take part in this expedition, as he has sailed to South Africa.

GENERAL.

The Distribution of Marine Mammals.—An interesting paper on the above subject has recently been contributed to the Zoological Society by the secretary, Dr. P. L. Sclater. The groups of aquatic mammals that are represented on the Earth's surface at the present time are three in number, viz. (1) The suborder of the Carnivora, containing the seals and their allies (Pinnipedia), which are semi-aquatic; (2) the Sirenia, now represented by only two forms—the manatee and dugong—which are mainly aquatic; and (3) the Cetacea, which are wholly aquatic. After briefly considering the principal representatives of these three groups, the author proceeds to divide the oceanic portion of the globe into six sea-regions, subsequently treating of the characteristic mammals of each region. These sea-regions are given as follows: (1) The North Atlantic Sea-region, or Arctatlantis, consisting of the northern portion of the Atlantic down to about 40° N. lat. This region is characterized by its seals, by the absence of sirenians, and by the possession of three peculiar genera of cetaceans. (2) The Mid-Atlantic Sea-region, or Mesatlantis, consisting of the middle portion of the Atlantic down to about the Tropic of Capricorn. The genus *Monachus*, or monk-seal, and the Sirenian genus *Manatus*, being restricted to this region. (3) The Indian Sea-region, or Indopelagia, containing the Indian ocean down to about the same degree of south latitude, and extending from the coast of Africa on the west to Australia and the Malay archipelago on the east. This region is characterized by the presence of

the Sirenian *Halicore* (the dugong), and by the absence of pinnipeds. (4) The North Pacific Sea-region, or Arctirenia, containing the northern portion of the Pacific ocean to about the Tropic of Cancer. The true seals (*Phoca*) are found in this region, in common with the North Atlantic, and three of the species of this genus appear to be actually identical in these two sea-regions. This region is also characterized by the presence of certain species of the eared seals (*Otariidæ*), which are unknown in the Atlantic down at least to 30° S. lat.; as the home of the (now extinct) Sirenian *Rhytina* and of the endemic cetacean *Rhachianectes*. (5) The Mid-Pacific Sea-region, or Mesirenia, containing the inter-tropical portion of the Pacific ocean; without true seals (*Phocidæ*), but having the eared seals (*Otaria*) and the sea-elephant (*Macrorhinus*) from the south. (6) The Southern Sea-region, or Notopelagia, containing the whole of the South Polar ocean all round the globe south of the above-mentioned limits, characterized by four endemic genera of *Rhocidæ*, and by the presence of many *Otariidæ*; without Sirenians, but with two endemic forms of cetaceans (*Neobalæna* and *Berardius*). The author, in conclusion, calls attention to some of the more remarkable points in the general distribution of the marine mammals, adopting the hypothesis of a former barrier of land between Africa and America in explanation of certain facts in connection with the subject.

The Vasco da Gama Celebrations in Portugal.—The Geographical Society of Lisbon has celebrated the fourth centenary of Vasco da Gama's departure for India, by the erection of new buildings, which were opened by the King and Queen on July 8, the date (old style) of the sailing of the ships from Lisbon. Papers were read on the occasion, and Lisbon and some other towns were illuminated at night, but the grand national celebrations, the proposed outline of which has already been announced, will not take place till next spring.

Geography in Education.—Prof. Spencer, of the University College of North Wales, has edited a useful Teachers' Handbook,* to which a number of specialists contribute chapters on the teaching of their own subjects. The primary object of the work is for the guidance of teachers in Wales, but it will be found of quite general application. It does not give a syllabus of the various subjects, and is concerned rather with the manner of teaching than with the matter taught. The chapter on geography is contributed by Mr. H. Yule Oldham, Lecturer on Geography in the University of Cambridge, and expresses well the views which have been generally accepted by geographers as to the educational importance of their science. Mr. Yule Oldham points out that the recognition of geography as an element in education is much more general than the ability to handle it effectively—"although acknowledged to be a weapon indispensable to a well-equipped educational armoury, it is too often left to rust on the shelves, or placed in inexperienced hands." In the short space available it was impossible to enter into details, but many useful hints are given as to the manner of commencing the teaching of geography, and the relative places of map-drawing, blackboard work, and modelling, and the treatment of physical, political, economic, and historical geography as parts of the whole subject. In the general awakening which seems to have set in amongst teachers as to the necessity for improvement in educational geography, this practical chapter should be found stimulating and helpful.

Anniversary Meeting.—The name of the first scrutineer mentioned in p. 110 of the July number should have been Captain J. Henderson Smith, and not Captain Bedford.

---

* 'Chapters on the Aims and Practice of Teaching,' edited by Frederick Spencer, M.A., PH.D. Cambridge: University Press. 1897.

CORRESPONDENCE.

"*Kech-Makurán.*"

HAVING been closely associated with Makrán affairs for the better part of two years, during the period that I held administrative charge of that country, the letters that have recently appeared in the *Geographical Journal* on the subject of Makrán have been full of interest for me, especially that communication on the subject in which General Haig has published the result of his study of the itineraries of the well-known Eastern authors whom he quotes. As I actually resided in that country during the period to which I have alluded, I venture with all humility to put together a few items of information, in the hope that, as my information was collected directly from the inhabitants themselves, with whom I was brought into very close contact while engaged in making the Revenue Settlement, the notes may prove of interest.

The "Kes Macorán" of Marco Polo is a very close approximation to the name of this country which is in use at the present day. From careful inquiries made on the spot, it appears that Kech (or Kej) and Makurán are considered as two distinct countries, although they are adjacent to one another.

The country of Kech is bounded on the east by the Upper Kolwah district. The Kolwah district is itself divided into two parts by the stream known as Tirtej. South of this stream there is the district or subdivision of Lower Kolwah, which is included in Kech. The Tirtej stream is therefore the eastern boundary of Kech. On the west Kej includes the subdivision known as Tump. The Boleda valley, 30 miles north of Kech, is considered to belong to the latter, the actual boundary between it and Panjgur being a spot about 18 miles north-east of the fort of Chib, in the Boleda valley.*

The northern limits of Kech, and also of Makrán, are formed by the watershed which divides the waters flowing into the Mashkel and Rakshan rivers from those of the Sarbáz river, and the Nahing and Dasht rivers as well, Panjgur being considered by the inhabitants as belonging to "Khorassan."

Bámpur is not considered as belonging to or included in the country known as Makurán. Makurán is a collection of districts, of which the best known are Mand, Sarbaz, Kasrkand, Báhu, and Kir-Bir, and others as well. It is probably owing to this that it is written sometimes in the plural—"Makranát," the Makrans—in Persian books. The names of the subdivisions just mentioned do not represent towns; each of these districts may contain several villages, and none of these may necessarily bear the name of the district.

Kech also is composed of many subdivisions, Kech, Tump, Boleda, and Lower Kolwah being the best known. In the Kech subdivision there are five or six villages, none of which are known as Kech; the chief of these villages is Turbat.

Panjgur is said to extend from the hills known as Band-i-Panjgur,† 40 miles to the east of the village of Isai, and to include the Párom district, 40 miles west of the same village. The area under permanent cultivation which depends on Karez irrigation contains several villages, of which those worthy of mention are Isai, Tasp, Khudabadan, and Garmkán, and not one of the villages is known as Panjgur.

Each village in these subdivisions is practically a distinct self-governing unit,

---

* The other forts are those of Bit, Koshk, and Suto.

† Or Panjgur Koh.

ruled by the "Rish safid," and the headman, who is called the "Ka-hudá" (a corruption of Kad Khuda). Under the orders of the latter are subordinate officials called "ghazirs," whose office is practically hereditary, and there may be one or more ghazirs in each village. The collection of villages situated in the part of the Panjgur valley which is permanently under cultivation has been called Panjgur by the British officials who are connected with the country and with the general supervision of its affairs, for the sake of convenience alone.

Wherever there are irrigation works of a permanent nature the date palm is extensively cultivated. It is grown on the borders of the fields, which are purposely made small, to afford a certain amount of protection from the direct rays of the sun, and prevent the rapid evaporation of moisture from the cultivated soil, and so prevent it becoming rapidly dry, and becoming hard and crusted. The fields are carefully tended, as if they were gardens. The rice, jowari, and other crops, such as tobacco, etc., are grown in nurseries, and when the young plants are an inch or two in height they are planted out in the fields, which have been carefully prepared to receive them. A group of date palms is called kallag, and the habitations, if any exist, are known variously as shahr, bázár, and res. The word "kalat" is also, of course, largely used.

The soil, which is a light clay, is very fruitful. On irrigated lands it is a common occurrence to obtain three or four harvests from one sowing of jowari; and even in ground dependent on the rainfall for irrigation, three crops have been obtained from a single sowing of jowari.

The letters *p* and *f* are frequently interchanged, as well in the colloquial as in the written language of Kech. Thus the well-known name *Pír Baksh* becomes corrupted very commonly into *Fir Baksh*. The name *Páhra* into *Fáhra*; *Panjgur* is also turned into *Fanjgur*; and *fakir* into *pakir*. The word *áp* ("water") is usually pronounced *áf*.

At the risk of appearing presumptuous, I venture to agree with the identification, by General Haig, of Pahra, near Bámpur (that is, the modern Persian fort of Nasrieh).* The "Masakand of Istakhri" (I am quoting General Haig) is probably Naskand, a well-known locality in Makrán (properly Makurán) to the south-east of Bámpur. The city of the Khwarij I should be inclined (with all deference, be it said) to place south of the watershed of the Sarbáz stream. Rask may well have been a district or subdivision, such as have been just described, in which case the "village of Yáhyah-bin Amr" would have, in all probability, been the principal village, the residence of the chief, or the more influential man of the district of Rask.

To talk of ruined cities in this part of the world is apt to prove misleading. Ancient sites in Kech Makurán are recognizable by the mounds of white clay covered with fragments of pottery which are found in all parts of Baluchistan, and known as "damb." These mounds are the remains of forts and dwellings. The latter are constructed at the present day of either pure clay or of sun-dried bricks set in clay mortar. Trunks or beams of the date palm (being the most common timber) are set in the walls, especially near angles, to bind the earth or masonry together. This system of building is probably that which has always been employed in the country. A large town or village in Kej (that is, the country known as Kej) consists of a fort (varying, of course, in size), which is the residence of the chief. Adjoining the fort there may be a dozen or so of houses built in the manner just described; these are the dwellings of the principal inhabitants, and the shops of the local merchants or dealers, who require a secure place for the storage of their

* This name was obtained in 1889–90 from local information at Jálk.

wares. The remainder of the population, however numerous, dwell in huts, either thatched with mats and palm branches, or constructed entirely of those materials. Scattered among the date groves are to be found the huts of a considerable number of inhabitants whose lands lie at some distance from the village. It cannot be expected that "ruins" such as are generally understood could be found, except where the destruction has been recent. A village such as that just described, if destroyed, would, in the lapse of years, form a mound composed of the *débris* of the more permanent buildings, the clods of earth or unbaked bricks of which would dissolve under the action of the elements.

The only ruins worthy of the name are those of the domed buildings containing tombs, and which are evidently mausolea, which have been constructed of carefully baked bricks and tiles set in clay mortar. These have been found to exist from the Gaud-i-Zirreh on the north all over Kharan, the Panjgur and Kech districts; those of Galugáh in the Máshkel have been already described by Colonel Holdich, C.B., etc., from information supplied by me. There are types of these buildings among the photographs I am sending to the Society; the general plan of the buildings does not vary, but the style of ornamentation does, and in many instances the representation of living objects is omitted.

The hills in the vicinity of such a village as that just described might be inhabited by a numerous and warlike tribe owning allegiance to the chief residing in the village, but these would dwell in tents, and the destruction of their habitations would result in a few handfuls of ashes.

The only instance of a carved stone is that contained in one of the photographs, in one of the panels of which there is a rude figure of a horseman armed with a bow.

At Jálwar, in the Kharan hills, I discovered inscriptions in what appeared to be Arabic characters cut with a blunt instrument into the face of a cliff, and I was informed that inscriptions exist in another locality in Makurán, which I have not had an opportunity, so far at least, of examining. It was a matter of deep regret that it was not possible to photograph the Jálwar inscriptions, or to devote time to copying them or to obtaining rubbings.

There are distinct traces of the occupation of Kech Makurán by the Moghals.* In the translation of the Tabakat-i-Nasiri by Major Raverty, treating of the subject, the name, given in a mutilated form, on the authority of the Jami-ut-tawarikh, of the locality in which the Moghal horde passed the summer (in a foot-note) could be easily made to read Panj Gur. This name is still written in two distinct syllables, as well as in one word.

The Miri fort in the Kech subdivision, which is at present in a ruinous condition itself, stands on a very extensive "damb" or mound, which is evidently that of a more extensive fort or group of habitations than the Miri fort represents.

There are two localities in Kech (that is, the country known by that name) which are known as Nag, one 25 miles north-west of the fort of Chib, in the Boleda valley, and the other about 40 miles to the east of the village of Turbat, in the Kech subdivision. At each of these two localities known as Nág there is an abundant supply of spring water. To the east of the village of Isai (in the Panjgur district), and about 80 miles distant from it, is the fort known as Naghai Kalat (the fort of the Nágha). Here there is also a fine spring of water.

The names of Kej (or Kech) and Panjgur are place-names of very great antiquity. The latter was the headquarters of the Administration, and the quarters of the civil

* At Dizak, in the "Perso-Baluch" country; also seen in names such as "Moghal-p-áb" ("the Spring of the Moghals"), "Moghal Khariná," and "Turki Ambár," frequently met with in Kech and Panjgur.

officer and his establishment were at the small village of Chitkán, where lines had also been constructed to house the troops stationed in the country. The surrounding villages used to be constantly visited for purposes of administrative work, as well as the surrounding country, and there are certainly more than five tombs in Panjgur.

GEO. P. TATE,
Survey of India Department.

Quetta.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1896–1897.

Fourteenth Ordinary Meeting, June 28, 1897.—Sir CLEMENTS MARKHAM, K.C.B., President, in the Chair.

ELECTIONS.—*Henry de Courcy Agnew; Mathew Arthur, D.L., J.P.; Frank Bateman; Edward Boyle, Barrister-at-Law; Captain Murray Cookesly (late 22nd Regiment); William Montgomery Crook, B.A.; William Fraser Hume, D.Sc.; M. H. Spencer Josephs; Claude G. Montefiore, M.A.; Thomas Dixon Rust; W. Gordon Sprigg; Edgar Salis-Schwabe; Alexander Tucker Wardrop (Customs and Harbour Officer); M. L. Wessels.*

The Paper read was:—

"Recent Journeys in Persia." By Captain Molesworth Sykes.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By HUGH ROBERT MILL, D.Sc., *Librarian*, R.G.S.

THE following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Com. = Commerce, Commercial.
C. Rd. = Comptes Rendus.
Erdk. = Erdkunde.
G. = Geography, Geographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
J. = Journal.
M. = Mitteilungen.
Mag. = Magazine.
P. = Proceedings.
R. = Royal.
Rev. = Review, Revue, Revista.
S. = Society, Société, Selskab.
Sitzb. = Sitzungsbericht.
T. = Transactions.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

EUROPE.

Austrian Alps. **Schjerning.**

Die Pinzgauer. Von Dr. Wilhelm Schjerning.—Forschungen zur deutschen Landes- und Volkskunde . . . herausgegeben von Dr. A. Kirchhoff. Zehnter Band. Heft 3. Stuttgart: J. Engelhorn, 1897. Size 9½ × 6½, pp. [104]. *Illustrations.*

A note on this paper was given in the June number of the *Journal*, vol. ix. p. 660.

Belgium—The Scheldt. *Mouvement G.* **14** (1897): 178–179, 197–198, 210–211. **Rutot.**

Le cours de l'Escaut à travers les âges géologiques, d'après une communication faite par M. A. Rutot à la Société belge de Géologie. *With Maps.*

France—Alps. *C. Rd.* **124** (1897): 1170–1173. **Martel.**

Sur l'hydrographie souterraine et les chouruns du Dévoluy (Hautes-Alpes). Note de M. E.-A. Martel.

France—Brittany. *Ann. G.* **6** (1897): 23–44, 103–122. **Barrois.**

Des divisions géographiques de la Bretagne. Par M. Charles Barrois. *With Map.*

A regional study, the concluding section of which is devoted to the effects on the people of the natural conditions of the district. In considering the history of Brittany, the author allows himself to forecast the future of the country as foreshadowed by the principles of geography.

France—Champagne. *Ann. G.* **6** (1897): 230–238. **Chantriot.**

La falaise de Champagne et le vignoble champenois. Par M. E. Chantriot.

France—Gascony. *C. Rd.* **124** (1897): 1041–1043. **Durègne.**

Sur le mode de formation des dunes primaires de Gascogne. Note de M. E. Durègne.

France—Seine. **Lemoine and Babinet.**

Ponts et Chaussées. Service Hydrométrique du Bassin de la Seine. Observations sur les Cours d'Eau et la pluie centralisées pendant l'année, 1895. . . . Par M. G. Lemoine et M. Babinet. Versailles. Size 17 × 11. *Diagrams.*

Résumé des Observations centralisées par le Service Hydrométrique du Bassin de la Seine pendant l'Année, 1895. Par M. Babinet. Versailles, 1896. Size 10½ × 7, pp. 54.

Germany—Hamburg. *M.G. Ges. Hamburg* **13** (1897): 131–140. **Gottsche.**

Die tiefsten Glacialablagerungen der Gegend von Hamburg. Vorläufige Mittheilung von Dr. C. Gottsche. *With Map.*

The maximum depth at which glacial clays have been found by borings in the neighbourhood of Hamburg is about 550 feet below the surface. The map shows the end-moraines of Schleswig-Holstein, together with the distribution of alluvial and diluvial formations.

Greece—Athens. *J.R.I. British Architects* (3) **4** (1897): 345–358. **Penrose.**

The Parthenon, and the Earthquake of 1894. By F. C. Penrose, F.R.S. *With Illustrations.*

The paper gives incidentally a history of the Parthenon.

Greece—Ionian Islands. *Cosmos* (2) **12** (1896): 97–108. **Stefani.**

Cenni geologici sull' Isola di Leucade. Per Carlo de Stefani. *With Maps.*

A description of the geology of the island known as Santo Mauro, or Leucada, in the Ionian group, with effective orographical and geological maps in colours.

Iceland. **Thoroddsen.**

Fra det nordlige Island. Rejseberetning fra Sommeren 1896. Af Dr. Phil. Th. Thoroddsen. (Særtryk af "Geografisk Tidsskrift," 14de Bind, 1ste—2 det Hefte.) Copenhagen. Size 12 × 9½, pp. 22. *Map. Presented by the Author.*

Mediterranean—Crete. *Ann. G.* **6** (1897): 255–257. **Ardaillon.**

Répartition des chrétiens et des musulmans dans l'île Crète. Par M. E. Ardaillon. *With Map.*

The map shows the regions in which there is an important Mussulman element in the population, and those in which the proportion exceeds one-half. The name of each town or village is followed by a number giving the percentage of Mussulmans in the population.

Norway. **Chapman.**

Wild Norway: with chapters on Spitsbergen, Denmark, etc. By Abel Chapman. London: E. Arnold, 1897. Size 9 × 6, pp. xiv. and 358. *Illustrations. Price* 16*s.*

Chapters on various parts of Norway, some of them rarely visited by the tourist, on Denmark, and on Spitsbergen, the last containing a contribution by Mr. Arnold Pike on "A Winter in the Eightieth Degree." The key-note of the work is sport, but this involves much reference to natural history.

Norway—Fauna. **Sars.**

Fauna Norvegiæ. Vol. i. Descriptions of the Norwegian Species at present known belonging to the Sub-orders Phyllocarida and Phyllopoda. By G. O. Sars.

Christiania: Printed by the Joint-Stock Printing Co, 1896. Size 13 × 10, pp. vi. and 144. *Plates.* [In Norwegian and English.] *Presented by the Royal University of Norway.*

Norway—Meteorology. **Mohn.**

Jahrbuch des Norwegischen Meteorologischen Instituts für 1893 (pp. x. and 110); 1894 (pp. x. and 110); 1895 (pp. x. and 110). Herausgegeben von Dr. H. Mohn. Christiania, 1895–96. Size 13½ × 10. *Presented by the Norwegian Meteorological Institute.*

Norway—Flora. **Norman.**

Norges Arktiske Flora. I. Speciel Plantetopografi. 1ste. Del J. M. Norman. Kristiania: Oscar Andersens Bogtrykkeri, 1894. Size 10 × 6½, pp. 760. *Map. Presented by the Royal University of Norway.*

On the arctic flora of Norway. The map is merely a topographical outline.

Poland. **Arçtowski.**

Henryk Arçtowski. Materyaty do Bibliografii prac naukowych Polskich. Zestawienie treści 14-tu tomów Pamiętnika Fizyograficznego 1881–1896. Bruksella, 1897. Size 10 × 7½, pp. 16. *Presented by the Author.*

Dr. Arçtowski here gives an index arranged according to the authors' names of the 14 volumes of the publications of the Polish Physiographical Memoirs. The titles are given in Polish, with a French translation.

Spain—Cantabrian Mountains. *G.Z.* **3** (1897): 278–281. **Penck.**

Die Picos de Europa und das kantabrische Gebirge. Von Albrecht Penck

A contribution to the morphology of the Iberian peninsula.

Spain—Galicia. *Blackwood's Mag.* **162** (1897): 109–119. **Lynch.**

An Unnoted Corner of Spain. By Hannah Lynch.

A gracefully written record of travel in the province of Galicia and along the north coast of Spain.

Sweden—Norbotten. **Schoener.**

Schwedens Högfjällgebiet. Von J. G. Schoener. (Separat-Abdruck aus Nr. 475 und 476 vom 1. und 15. April 1897 der "Oesterr. Alpen-Zeitung.") Wien. Size 11 × 8, pp. 12. *Presented by the Author.*

Switzerland—Jungfrau Railway. **Guyer-Zeller.**

The Proposed Jungfrau Railway rising to an altitude of 13,670 feet. Considered from its scientific, technical, and financial aspects. Zürich: Printed by F. Schulthess, 1897. Size 11½ × 8½, pp. 86. *Map and Plates accompanying. Presented by the Jungfrau Railway Syndicate.*

Full plans are given for the most remarkable mountain railway ever projected, and the accompanying pamphlet considers the practicability of the scheme in all aspects, scientific, engineering, hygienic, and financial.

Switzerland—Jungfrau. *Deutsche Rundschau G.* **19** (1897): 241–249, 299–311. **Wottitz.**

Die Jungfraubahn. Von J. Wottitz. *With Map and Illustrations.*

An account of the projected railway up the Jungfrau.

Switzerland—Lake of Geneva. **Halbfass.**

Morphometrie des Genfersees. Von Dr. Wilhelm Halbfass. Size 8½ × 5½, pp. [28]. *Plate. Presented by the Author.*

A discussion based on the map of the official Swiss bathymetrical map of the lake.

Switzerland—Map. **Früh.**

Ein Relief der Schweiz. Von Dr. J. Früh in Zürich. Separatabdruck aus der Schweizerischen Pädagogischen Zeitschrift. VII. Jahrgang 1897, Heft iii. Zürich, 1897. Size 9½ × 6½, pp. 12. *Presented by the Author.*

On the educational utility of the proposed relief-map of Switzerland on the natural scale (for height and horizontal distance) of 1: 100,000. The author points out the faintness of the relief on this scale, and suggests the production of a larger-scale relief map.

Switzerland—Saas. **Balch.**

Ascents near Saas. By Edwin Swift Balch. Reprinted from *Appalachia*, vol. viii., No. 2. [Boston, 1896.] Size 10 × 6, pp. [8]. *Plates. Presented by the Author.*

Switzerland—Saas Valley. **Coolidge.**

Quelques nous de lieux dans la vallée de Saäs. (Separat-Abdruck aus dem "Anzeiger für Schweiz. Geschichte," Nr. 6, 1896 und Nr. 1, 1897.) Par W. A. B. Coolidge. Size 10 × 7, pp. 12. *Presented by the Author.*

Turkey. *G.Z.* 3 (1897): 249–256. **Vambéry.**

Die Stellung der Türken in Europa. Von H. Vambéry.

Prof. Vambéry discusses the composition of the population in European Turkey, and incidentally the position of Turkey with regard to the great Powers.

United Kingdom—England. *J. Manchester G.S.* 12, 1896 (1897): 157–167. **Wells.**

The Canals and Navigable Rivers of England. By Lionel E. Wells.

United Kingdom—England—Herefordshire. **Bevan, Davies, and Haverfield.**

An Archæological Survey of Herefordshire. By the Rev. J. O. Bevan, M.A.; James Davies; and F. Haverfield, M.A. Westminster: Printed by Nichols & Sons, 1896. Size 12 × 10, pp. 16. *Map.*

The pre-Conquest antiquities of Herefordshire have been catalogued, and their positions recorded by appropriate signs on a map on the scale of 4 miles to 1 inch.

United Kingdom—England—Lancashire. **Harrison.**

An Archæological Survey of Lancashire. By William Harrison. Westminster: Printed by Nichols & Sons, 1896. Size 12 × 10, pp. 26. *Map.*

The district covered by this survey, and incorporated in the accompanying map, extends beyond the borders of Lancashire, and, including the greater part of the Lake District and some of Western Yorkshire, affords an excellent opportunity for cataloguing the antiquities and showing the mutual relations of ancient sites in the north-west of England.

United Kingdom—England—Lancashire. **Bolton.**

J. Manchester G.S. 12, 1896 (1897): 188–197.

The Physical Geography of North-East Lancashire. By Herbert Bolton. *With Map and Illustrations.*

A good piece of local geography.

United Kingdom—England—Southport. **Baxendell.**

Borough of Southport, Meteorological Department. The Fernley Observatory, Southport. Report, and Results of Observations, for the year 1896. By Joseph Baxendell. Southport, 1897. Size 10 × 7½, pp. 30.

United Kingdom—Scotland. **Blaikie.**

Itinerary of Prince Charles Edward Stuart, from his landing in Scotland, July, 1745, to his departure in September, 1746. Compiled from *The Lyon in Mourning*, supplemented and corrected from other contemporary sources by Walter Biggar Blaikie. With a Map. Edinburgh: Printed . . . by T. & A. Constable for the Scottish History Society, 1897. Size 9 × 6, pp. xvi. and 136. *Illustrations. Presented by the Author.*

This singularly interesting work will receive a special notice.

ASIA.

Afghanistan. **McMahon.**

The Southern Borderlands of Afghanistan. By Captain A. H. McMahon. From the *Geographical Journal* for April, 1897. Size 10 × 6½, pp. 24. *Map and Illustrations.*

Ceylon. *M.G. Ges. Hamburg* 13 (1897): 70–91. **Geiger.**

Ceylon und seine Bewohner. Von Prof. Dr. Wilhelm Geiger.

A general account of a visit to Ceylon in 1895–96, undertaken on behalf of the Bavarian Academy of Sciences in order to pursue linguistic and historical studies.

China—Lighthouses, etc. ———

China. Imperial Maritime Customs. III.—Miscellaneous series: No. 6, List of the Chinese Lighthouses, Light-Vessels, Buoys, and Beacons for 1897. (Corrected to December 1, 1896.) Twenty-fifth Issue. Shanghai: Statistical Department of the Inspectorate General of Customs, 1897. Size 11 × 9, pp. 52. *Charts.*

The position of all the Chinese coast and river lights is shown in three charts.

Dutch East Indies. **Van der Chijs.**

Nederlandsch-Indisch Plakaatboek, 1602–1811. Door J. A. Van der Chijs. Vijftiende Deel, 1808–1809. Batavia, 1896. Size 8½ × 5½, pp. 1164.

India. *J.S. Arts* 45 (1897): 561–571. **Black.**

The Railway to India. By C. E. D. Black. *With Map.*

The proposed railway route to India is from Alexandria to the head of the Gulf of

Akaba, thence across Northern Arabia to the Euphrates, and on by Basra, the eastern side of the Persian gulf, and along the south of Baluchistan to Kurrachee.

India—Assam. ———

Report on the River-borne Trade of Assam for the Quarter ending September 30, 1896. [Shillong, 1897.] Size 13½ × 8½, pp. 42.

India—Burma. *Fortnightly Rev.* **62** (1897): 86–104. **Parker.**

The Burmo-Chinese Frontier and the Kakhyen Tribes. By E. H. Parker.

An account of a journey from Bhamo in 1893 through the territory of the Kakhyen tribes.

India—Kulu. *Globus* **71** (1897): 1–8, 23–29. **Oppert.**

Reise nach Kulu im Himâlaya. Von Prof. Gustav Oppert. *With Illustrations.*

India—Rainfall. *Nature* **56** (1897): 110–115. ———

Periodic Variations of Rainfall in India. By J. E.

An elaborate study of the variations of Indian rainfall which appears not to be associated with similar variations of the same or opposite phase in other parts of the world.

Malay Archipelago—Celebes. *Rev. Maritime* **133** (1897): 5–17. ———

Renseignements recueillis à Macassar par le "Duguay-Trouin."

Palestine. **Whitty.**

Palestine Exploration: Further Revelations! chiefly concerning the Discovery of "Whitty's Wall" at Jerusalem (King Solomon's Rampart). By the Rev. John Irwine Whitty, LL.D., etc. London: Simpkin & Co., 1897. Size 8½ × 5½, pp. 50. *Map. Presented by the Author.*

Siberia—Gold. *Rev. Scientifique* (4) **7** (1897): 513–528. **Sabachnikoff and Levat.**

Les placers aurifères de la Sibérie orientale. Par T. Sabachnikoff et E. D. Levat. *With Map and Illustration.*

Gives an account of the method of prospecting for gold used in Eastern Siberia, and of the working of the placers, with special reference to the economic conditions of Russian gold-mining.

Tibet—Sanpo. *Globus* **71** (1897): 334–339. **Reichelt.**

Der Tsangpo-Brahmaputrafluss von der Quelle bis Sadiya. Von G. Th. Reichelt. *With Maps.*

Western Asia. **Bigham.**

A Ride through Western Asia. By Clive Bigham. London: Macmillan & Co., 1897. Size 9½ × 6, pp. xii. and 284. *Maps and Illustrations. Price 8s. 6d. Presented by the Publishers.*

Mr. Bigham, in the course of thirteen months, travelled through Asia-Minor, visiting Angora, Sivas, Ersinjan, Erzerum, Bayazid, and then entered Persia, through which he made a number of routes, some leading him into regions very rarely visited. He also made a rapid visit to Mesopotamia, and concluded his already extensive travels by a run to Samarkand on the Trans-Caspian railway, a journey to Kashgar, and a crossing of the Tian Shan to the Siberian railway line, by which he returned to Europe. The narrative is lively and concise, the illustrative photographs well selected, and the maps show the numerous routes clearly.

AFRICA.

Africa—People. *Cosmos* (2) **12** (1895–96): 82–89, 145–153. **Lenz.**

Sui cosidetti "popoli nani" dell' Africa, pel dott. Oscarre Lenz.

On the dwarf-peoples of Africa.

Africa. **Peters.**

Lecture delivered by Dr. Carl Peters on the Future of Africa, at the Society of Arts, on March 5, 1897. London, 1897. Size 9 × 6, pp. 16.

Algerian Sahara. *Ann. G.* **6** (1897): 147–168. **Hess.**

L'Extrême-Sud algérien et le Touat. Par M. Jean Hess. *With Map and Photographs.*

British East Africa—Uganda. **Vandeleur.**

Two Years' Travel in Uganda, Unyoro, and on the Upper Nile. By C. F. S. Vandeleur, D.S.O. From the *Geographical Journal* for April, 1897. Size 10 × 6½, pp. 26. *With Map and Illustrations.*

East Africa—Somaliland. *B.S.G. Română* **17** (1896): 5-30. **Ghica-Comănesci.**
O călătorie prin țara Somalilor. Conferință . . . de Dim. Ghica-Comănesci. *With Map and Illustrations.*

East Africa—Victoria Nyanza. *Petermanns M.* **43** (1897): 77-80. **Brard.**
Der Victoria-Nyansa. Von Pater Brard. *With Map.*

On the southern part of the Victoria Nyanza.

Eastern Africa. *Export* **19** (1897): 131-133, 143-145. **Reinisch.**
Ein Blick auf Aegypten und Abessinien. Von Leo Reinisch.

German East Africa. *Koloniales Jahrb.* **10** (1897): 1-17. **Bernhard.**
Ueber Eisenbahnprojekte in Deutsch-Ost-Afrika. Von L. Bernhard.

German East Africa. *Koloniales Jahrb.* **10** (1897): 40-62. **Maercker.**
Landesaufnahme von Deutsch-Ostafrika. Von Maercker.

German South-West Africa. *M.G. Ges. Hamburg* **13** (1897): 58-69. **Dove.**
Wissenschaftliche Aufgaben in Südwestafrika. Von Dr. K. Dove.

German South-West Africa. *M.G. Ges. Hamburg* **13** (1897): 141-142. **Hartmann.**
Bemerkungen zur Vorläufigen Karte des Koncessions-Gebietes des South-West Africa Co., Lim. Von Premier-lieutenant à la suite Dr. ph. Hartmann. *With Map.*

The map is on the scale of 1 : 500,000.

Italian East Africa—Erythrea. **De la Jonquière.**
C. De la Jonquière. Les Italiens en Érythrée. Quinze ans de Politique coloniale. Paris: H. Charles-Lavauzelle [not dated, 1897?]. Size 9 × 6, pp. 352. *Maps. Price 5s.*

The subordinate place given to dates throughout this work reduces its value as a book of reference. It gives a continuous history of Italian enterprise in East Africa, and details of the recent disastrous war. There are numerous sketch-maps.

Portuguese West Africa. *Mouvement G.* **14** (1897): 175-178. ———
Le Chemin de Fer d'Ambaka. *With Map.*

On the railway from Loanda to Ambaka, and its projected extension.

South Africa. **Schulz and Hammar.**
The New Africa. A Journey up the Chobe and down the Okovanga Rivers. A record of Exploration and Sport. By Aurel Schulz, M.D., and August Hammar, C.E. With a newly drawn Map of hitherto unexplored parts of the Country, and Seventy Illustrations from Original Drawings by the Authors, and Photographs. London: W. Heinemann, 1897. Size 9½ × 6, pp. xii. and 406. *Price 28s. Presented by the Publisher.*

South Africa—Zambesi. *Rev. Scientifique* (4) **7** (1897): 561-564. **Foa.**
Un voyage sur les bords du Zambèze, d'après M. E. Foa. *With Illustrations.*

Tunis. *Ann. G.* **6** (1897): 239-254. **Blanchet.**
Le Djebel Demmer. Par M. P. Blanchet. *With Map.*

The author resuscitates the old Arab name, Jebel Demmer, for the whole mountain backbone of Southern Tunis, at present known under different names in its different natural divisions.

West Africa. *Ann. G.* **6** (1897): 133-146. **Toutée.**
Principaux résultats géographiques de la mission Toutée. *With Map.*

West Africa. **Harford-Battersby.**
Niger and Yoruba Notes. A Record of Work in Western Equatorial Africa. Vols. i. and ii. Edited by C. F. Harford-Battersby, M.D. London: Marshall Bros., 1895 and 1896. Size 10 × 7½, pp. (vol. i.) iv., 48, and 48; (vol. ii.) iv. and 96. *Maps. Presented by the Editor.*

NORTH AMERICA.

Canada. **Dawson, Tyrrell, Low.**
Recent Explorations in Canada, 1895-96. I. Introductory Sketch. By G. M. Dawson, C.M.G., etc. 2. The Barren Lands of Canada. By J. Burr Tyrrell, M.A., etc. 3. The Labrador Area. By A. P. Low, B.A.Sc., etc. Reprinted from the *Ottawa Naturalist*, vol. x. No. 11. Ottawa, March, 1897. Size 9 × 6, pp. [16].

Canada—Bell River. *B. Geolog. S. America* **8** (1897): 241–250. **Bell.**
Evidences of North-easterly differential rising of the land along Bell River. By Robert Bell. *With Maps. Presented by the Author.*

Canada—Gulf of St. Lawrence. *Ann. Hydrographie* **25** (1897): 116–122. **Schott.**
Weitere Beiträge zur Hydrographie des St. Lorenz-Golfes. Nach den Kanadischen Berichten bearbeitet von Dr. Gerhard Schott. *With Plate.*

Canada—Mineral Industry. **Ingall.**
Geological Survey of Canada, G. M. Dawson, C.M.G., etc., Director. Part S. Annual Report, vol viii. Section of Mineral Statistics and Mines, Annual Report for 1895. Elfric Drew Ingall. Ottawa, 1897. Size 10 × 7, pp. 104.

Historical. **Winship.**
The Coronado Expedition, 1540–1542. By George Parker Winship. Extract from the Fourteenth Annual Report of the Bureau of Ethnology. Washington, 1896. Size 11½ × 8, pp. 327–638. *Illustrations and Facsimile Maps. Presented by the U.S. Bureau of Ethnology.*

This will be specially noticed.

United States. ———
Annual Report of the Chief of Engineers, United States Army, to the Secretary of War, for the year 1896. Six Parts. Washington, 1896. Size 9½ × 6, pp. 4196. *Maps and Diagrams. Presented by the Engineer Department, U.S. Army.*

This voluminous report gives particulars of the public works carried out on the navigable rivers of the United States in 1896.

United States—Alaska. **Schott.**
Standard Geodetic Positions in South-Eastern Alaska, depending on astronomic observations made during 1892–93–94. Reports of December 27, 1893; March 28 and August 7, 1894. By C. A. Schott.—Report of the Superintendent of the U.S. Coast and Geodetic Survey . . . 1894. Part ii. Pp. 71–85. Washington, 1895. Size 12 × 9.

United States—Alaska. **Schott.**
Distribution of the magnetic declination in Alaska and adjacent waters for the year 1895. Report by C. A. Schott.—Report of the Superintendent of the U.S. Coast and Geodetic Survey . . . 1894. Part ii. Pp. 87–100. Washington, 1895. Size 12 × 9. *Charts.*

United States—Massachusetts. ———
Geographic positions in the State of Massachusetts, 1832–1890 (second enlarged and revised edition).—Report of the Superintendent of the U.S. Coast and Geodetic Survey . . . 1894. Part ii. Pp. 349–615. Washington, 1895. Size 12 × 9. *Charts.*

CENTRAL AND SOUTH AMERICA.

Bolivia—Rio Beni. **Heath and Ballivian.**
Ministerio de Instruccion Publica y Fomento. La exploracion del Rio Beni. Revista historica, por el Dr. Edwin R. Heath. Traducida y anotada por Manuel V. Ballivian. La Paz, 1896. Size 8½ × 6, pp. iii., 89, and xx.

British Honduras. ———
[British Honduras: Addresses of Welcome to Sir A. Moloney, 1896.] Size 13½ × 8½, pp. 12.

Central America. **Sapper.**
Das Nördliche Mittel-Amerika nebst einem Ausflug nach dem Hochland von Anahuac. Reisen und Studien aus den Jahren 1888–1895. Von Dr. Carl Sapper. Braunschweig: F. Vieweg und Sohn, 1897. Size 9½ × 6, pp. xii. and 436. *With Portrait, Maps, and Plans. Price 9s.*

This book brings together the important information which Dr. Carl Sapper has been accumulating on Central America during the last seven years. It deals with all the conditions of geography, and is illustrated by a series of very useful general physical maps.

Ecuador—Rio Napo. **Dolby-Tyler and Giglioli.**
Gli ultimi giorni dell' Età della Pietra (America meridionale). Di alcuni strumenti litici tuttora in uso presso certe tribù del Rio Napo. Nota di Carlo H. Dolby-Tyler ed Enrico H. Giglioli. (Estratto dall' *Archivio per l'Antropologia e l'Etnologia*, vol. xxv. Fascicolo 3°, 1895.) Size 10 × 6½, pp. 14. *Presented by Prof. cav. Enrico H. Giglioli.*

On stone implements in use on the Rio Napo.

WEST INDIES.

West Indies. **Newton.**

Glimpses of Life in Bermuda and the Tropics. By Margaret Newton. London: Digby, Long & Co. [1897.] Size 8 × 5½, pp. xii. and 256. *Illustrations.* *Price* 6*s.* *Presented by the Publishers.*

The authoress gives a pleasant account of an agreeable holiday spent in sketching in Bermuda and the West Indies, most of the islands of which, lying on the mail-route, were visited. A selection of clever pen-and-ink sketches illustrates the book.

West Indies—Virgin Islands. *G.Z.* **3** (1897): 121–137. **Deckert.**

Politisch-geographische Betrachtungen über Westindien. Von Dr. Emil Deckert. IV. Die Jungferninseln.

AUSTRALASIA AND OCEANIC ISLANDS.

Australia. *J. Manchester G.S.* **12** (1896) (1897): 109–127. **Harper.**

The Growth and Progress of the Australian Colonies. By W. Harper. *With Map.*

Australia—Alps. *J.R.G.S. Australasia* **6** (1896): 75–96. **Helms.**

The Australian Alps, or Snowy Mountains. By Richard Helms.

New South Wales—Historical. ———

The Brabourne Papers. (Relating to the Settlement and Early History of the Colony; purchased from Lord Brabourne by Sir Saul Samuel, Agent-General.) A Pamphlet containing a Summary of the Contents of these important Papers. Re-print of a pamphlet published in 1886 by Charles Potter, Government Printer, Sydney. Size 9½ × 6, pp. 48.

The "Brabourne Papers" are really the letters preserved by Sir Joseph Banks, which were addressed to him by correspondents, mainly in the recently founded colony of New South Wales, on the early history of which they throw much new light. This pamphlet is a summary and table of contents of the whole collection, which will ultimately be published in its entirety.

Queensland—Anthills. *P.R.S. Queensland* **12** (1897): 99–100. **Jack.**

Note on the "Meridional Anthills" of the Cape York Peninsula. By R. L. Jack.

A note describing the remarkable anthills of northern Queensland, built by termites, and possessing the curious characteristic of being placed due north and south. The reason for this is stated by Mr. Jack to be that in that position they secure the maximum of desiccation.

Queensland—Meteorology. *J. Manchester G.S.* **12**, 1896 (1897): 128–136. **Wragge.**

Meteorology of Queensland. By Clement L. Wragge.

Solomon Islands—New Georgia. *J. Anthrop. I.* **26** (1897): 357–412. **Somerville.**

Ethnographical Notes in New Georgia, Solomon Islands. By Lieut. Boyle T. Somerville. *With Illustrations.*

Victoria—Geology. **Stirling.**

The Geological Society of Australasia. Session, 1896. Inaugural Address by the President, James Stirling, September 25, 1896. Size 8½ × 5½, pp. 16.

A summary of the geology of Victoria, with special reference to the minerals of economic value.

POLAR REGIONS.

Antarctic. **Arctowski.**

Quelques remarques sur l'intérêt qu'offre pour la géologie l'exploration des régions antarctiques. Par H. Arçtowski. (Extrait du Bulletin de la Société Belge de Géologie, etc. Tome X. Année 1896.) Size 10 × 6½, pp. 4. *Presented by the Author.*

Dr. Arçtowski of the Belgian Antarctic Expedition suggests that the tertiary rocks of the Andes reappear in Grahamsland, which he believes to be a prolongation of the American continental axis.

Antarctic. *Globus* **71** (1897): 320–325. **Lindeman.**

Die neueren Reisen zur geographischen Erforschung der Südpolarregion und der deutsche Plan. Von M. Lindeman. III. (Schluss.) *With Illustrations.*

This concludes Herr Lindemann's excellent *résumé* of the history of antarctic exploration.

Arctic. **Simon.**

Henry Simon's occasional Letter. Special Nansen Number. April, 1897. Manchester. Size 14 × 8½, pp. 8. *Portrait and Illustrations.*

Arctic and Antarctic. *J.S. Arts* **45** (1897): 632–636. **Trevor-Battye.**

Arctic and Antarctic. By Aubyn Trevor-Battye.

Arctic—Nansen's Voyage. *Ann. G.* **6** (1897): 71–78, 169–180. **Zimmermann.**

Le voyage de Nansen et les Théories sur les courants du pôle boréal. Par M. M Zimmermann.

Greenland. *Petermanns M* **43** (1897): 86–95. **Hartz.**

Die dänische Expedition nach Ostgrönland 1891–92. Von N. Hartz. *With Map.*

Describes and gives a geological sketch-map of Scoresby Sound.

Spitsbergen. **Conway.**

The First Crossing of Spitsbergen. By Sir W. Martin Conway. From the *Geographical Journal* for April, 1897. Size 10 × 6½. *Maps and Illustrations.*

MATHEMATICAL GEOGRAPHY.

Astronomical. ———

Tables used in the Nautical Almanac Office for the calculation of the Occultations of Stars by the Moon generally, together with special tables adapted for the Royal Observatories at Greenwich and the Cape of Good Hope. London: Printed . . . by Darling & Son, 1896. Size 13½ × 8½, pp. 48.

Geodesy. *Knowledge* **20** (1897): 148–150. **Fowler.**

Measurement of the Earth. By A Fowler. (*Illustrated.*)

An account of some historical geodetic surveys, with a photograph of the monument at Hammerfest commemorating the end of the triangulated meridional arc from the mouth of the Danube.

Geodesy. ———

Formulæ and tables of factors for the computation of geodetic positions (fourth revised and enlarged edition).—Report of the Superintendent of the U.S Coast and Geodetic Survey . . . 1894. Part ii. Pp. 277–348. Washington, 1895. Size 12 × 9.

Photographic Surveying. *Ann. G.* **6** (1897): 97–102. **De la Noë.**

Les méthodes photographiques en topographie. Par M. le général de la Noë.

An epitome of the results obtained in Switzerland by Herr Rosenmund, who decided, after experiments, that photographic methods were of unique value only in reducing the time necessary to be spent in the field, and that they should only be employed in cases where the number of days in the year available for field-work was very small.

Position—Determination. *Ann Hydrographie* **25** (1897): 122–127. **Tetens.**

Ueber geographische Ortsbestimmung an Lande ohne astronomische Instrumente. Von Otto Tetens.

A statement of Dr. Paul Herzer's method of observing for position without instruments.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Air and Life. **Russell.**

Smithsonian Miscellaneous Collections. 1072. Hodgkins Fund. The Atmosphere in relation to Human Life and Health. By Francis Albert Rollo Russell. Washington: The Smithsonian Institution, 1896. Size 10 × 6, pp. 148.

Air and Life. **Varigny.**

Smithsonian Miscellaneous Collections. 1071. Hodgkins Fund. Air and Life. By Henry de Varigny, M.D., etc. Washington, 1896. Size 10 × 6½, pp. 70.

Dr. Varigny's essay was awarded the third prize of £250 in the competition for the Hodgkins Prize recently held in Washington. It deals comprehensively with the composition of the atmosphere, and with the relations of air to life.

Air in Towns. **Cohen.**

Smithsonian Miscellaneous Collections. 1073. Hodgkins Fund. The Air of Towns. By Dr. J. B. Cohen. Washington, 1896. Size 10 × 6½, pp. 42. *Plates.*

Atmospheric Sounds. *Globus* **71** (1897): 333–334. **Sieger.**

Seeschiessen, Wasserschüsse, Nebelrülpse, Luftpuffe. Von Dr. R. Sieger.

Geodesy. **Hirsch.**

Comptes-Rendus des Séances de la Commission Permanente de l'Association Géodésique Internationale réunie à Lausanne du 15 au 21 octobre 1896 rédigés par le Secrétaire perpétuel A. Hirsch, suivis des Rapports sur les travaux géodésiques accomplis dans les différents pays pendant la dernière année. Berlin: D. Reimer, 1897. Size 11½ × 9, pp. 318. *Maps and Plate.*

Amongst the more important reports and maps in this volume are those dealing with the triangulation of Italy and of Japan.

Gravity. **Preston.**

Telegraphic determination of the force of gravity at Baltimore, Md., from simultaneous observations at Washington and Baltimore. By E. D. Preston.—Report of the Superintendent of the U.S. Coast and Geodetic Survey . . . 1894. Part ii. Pp. 57–70. Washington, 1895. Size 12 × 9.

Gravity Measure. **Putnam and Gilbert.**

Relative determination of gravity with half-second pendulums, and other pendulum investigations. By G. R. Putnam; and a report on a geological examination of some Coast and Geodetic Survey gravity stations. By G. K. Gilbert.—Report of the Superintendent of the U.S. Coast and Geodetic Survey . . . 1894. Part ii. Pp. 7–55. Washington, 1895. Size 12 × 9.

Meteorology. **Duclaux.**

Smithsonian Contributions to Knowledge. 1034. Hodgkins Fund. Atmospheric Actinometry and the Actinic Constitution of the Atmosphere. By E. Duclaux. Washington: the Smithsonian Institution, 1896. Size 13½ × 10, pp. 48. *Presented by the Smithsonian Institution.*

Meteorology. **Gebelin.**

Les limites géographiques du Climat Tempéré. Communication faite au Congrès national des Sociétés françaises de Géographie le 6 Août 1895 (16e Session: Bordeaux). Par Jacques Gebelin. Bordeaux: Feret et Fils, 1896. Size 10 × 6½, pp. 10. *Map.*

The author's definition of "temperate" climate includes on his map Spitsbergen and the Punjab.

Meteorology. **McAdie.**

Smithsonian Miscellaneous Collections. 1077. Hodgkins Fund. Equipment and Work of an Aero-physical Observatory. By Alexander McAdie. Washington: the Smithsonian Institution, 1897. Size 10 × 6½, pp. 30. *Presented by the Smithsonian Institution.*

This essay discusses the equipment and sphere of work of a laboratory devoted to the study of the physical conditions of the atmosphere, such as has been proposed for one of the American universities.

Ocean Depths. ———

List of Oceanic Depths and Serial Temperature Observations received at the Admiralty during the year 1896, from H.M. Surveying Ships, Indian Marine Survey and British Submarine Telegraph Companies. Hydrographic Department, Admiralty, London, February, 1897. Size 13½ × 8½, pp. 20. *Presented by the Hydrographic Department, Admiralty.*

Oceanography—Tides. **Harris.**

Manual of Tides, Part iii. Some connections between harmonic and non-harmonic quantities, including applications to the reduction and prediction of tides. By Rollin A. Harris. Report of the Superintendent of the U.S. Coast and Geodetic Survey . . . 1894. Part ii. Pp. 125–262. Washington, 1895. Size 12 × 9. *Tables.*

Plant-Geography. *Abh. k. A. Wiss. Berlin* (1896): 1–28, 1–36. **Engler.**

Ueber die geographische Verbreitung der Rutaceen im Verhältniss zu ihrer systematischen Gliederung. Von Hrn. Adolf Engler. *With Maps.*

Ueber die geographische Verbreitung der Zygophyllaceen im Verhältniss zu ihrer systematischen Gliederung. Von Hrn. Adolf Engler. *With Maps.*

Numerous clear maps are given, showing the distribution of a large number of separate species.

Seismology. *Rev. Scientifique* **7** (1897): 360–362. **Lapparent.**

Les mouvements de l'écorce terrestre. Par M. A. de Lapparent.

It is gratifying to observe that M. de Lapparent acknowledges the assistance given him by the notices of geographical literature in this *Journal.*

Terrestrial Magnetism. **Bauer.**

On the distribution and the secular variation of Terrestrial Magnetism. No. iv. On the component fields of the Earth's permanent Magnetism. [Abstract.] By L. A. Bauer. (Reprinted from *Terrestrial Magnetism.*) Size 9½ × 7, pp. [7]. *Chart. Presented by the Author.*

Terrestrial Magnetism. *Terrestrial Magnetism* **2** (1897): 27–31. **Schmidt.**

On the Distribution of Magnetic Observatories over the Globe. By Adolf Schmidt.

Terrestrial Magnetism. ———

Comparison and Reduction of Magnetic Observations.—Report of the Committee, consisting of Prof. W. G. Adams, Dr. C. Chree, Lord Kelvin, Prof. G. H. Darwin, Prof. G. Chrystal, Prof. A. Schuster, Captain E. W. Creak, the Astronomer Royal, Mr. William Ellis, and Prof. A. W. Rücker. (Section A. British Association Meeting, Liverpool, 1896.) Size 8½ × 5½, pp. 12.

Tidal Phenomena. *American J. Science* (4) **3** (1897): 406–412. **Duff.**

Seiches on the Bay of Fundy. By A. Wilmer Duff.

The author traces the secondary undulations of a recording tide-gauge on the Bay of Fundy to seiches concerning which he confirms Forel's theory that they are due to the free vibration of the whole water in a basin.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Ancient Geography. **Tozer.**

A History of Ancient Geography. By H. F. Tozer, M.A. Cambridge: The University Press, 1897. Size 8 × 5½, pp. xviii. and 388. *Maps. Price* 10*s.* 6*d. Presented by the Cambridge University Press.*

A special notice of this book will be given.

Anthropogeography. *Rev. Scientifique* (4) **7** (1897): 353–360. **De la Blache.**

L'éducation des indigènes. Par M. P. Vidal de la Blache.

Discusses the problem of education for the natives in French colonies, which is recognized as difficult and delicate, but not impossible of solution.

Anthropogeography. *B. American G.S.* **29** (1897): 1–12. **Mindeleff.**

The Influence of Geographic Environment. By Cosmos Mindeleff.

This theme is treated with reference to the Pueblo Indians of the south-west of the United States, who have for many centuries inhabited a country of pronounced and exceptional natural features.

Anthropogeography. *G.Z.* **3** (1897): 268–278. **Ratzel.**

Die geographische Methode in der Ethnographie. Von Friedrich Ratzel.

In the form of a criticism of Achelis' "Moderne Völkerkunde," Prof. Ratzel gives an interesting exposition of the application of geographical method to ethnography.

Anthropology. *M. Deutsch. Schutzgeb.* **10** (1897): 1–25. **Seidel.**

Instruktion für ethnographische Beobachtungen und Sammlungen in Togo. . . . Bearbeitet von H. Seidel.

A series of questions for the special guidance of German officials in Togo, with the object of fully studying the anthropological conditions.

Arab Geography. *G.Z.* **3** (1897): 137–146. **Schwarz.**

Die ältere geographische Litteratur der Araber. Von P. Schwarz.

Notes on some of the older Arab geographers, especially Ibn Khordadbe (ca. 850), and Mukadasi (ca. 1070).

Cabot's Voyage. *Blackwood's Mag.* **161** (1897): 838–851. ———

John Cabot: an Anniversary Story.

Civilisation. *J. R. Statistical S.* **60** (1897): 148–161. **Rubin.**

A Measure of Civilisation. By Marcus Rubin. Translated by A. W. Flux, M.A.

Historical—Albuquerque. **Rebello.**

J. J. de Brito Rebello. Ementas historicas. I. A edade de Affonso de Albuquerque. Coimbra, 1896. Size 10 × 7, pp. 26. *Presented by the Author.*

Historical—Asiatic Trade. *M.G. Ges. Hamburg* **13** (1897): 92–130. **Baasch.**

Die Anfänge des modernen Verkehrs Hamburgs mit Vorderindien u. Ostasien. Von Dr. Ernst Baasch.

On the early trade between India and Hamburg by sea; but this trade only began in 1791, and for the next ten years the annual number of vessels from India and China to Hamburg varied from two to seven.

NEW MAPS.

By J. COLES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

Publications issued since June 8, 1897.

1-inch—General Map:—

ENGLAND AND WALES:—123, 139, hills photozincographed in brown, 1*s.* each.

6-inch—County Maps (revised):—

ENGLAND AND WALES:—**Hampshire**, 9 N.E., 10 N.W., S.E., 17 S.W., S.E., 18 N.W., 19 N.W., 23 N.E., S.W., S.E., 24 N.E., 25 N.W., N.E., 26 S.W., 27 N.W., S.E., 28 N.W., S.W., 30 N.E., 31 N.W., 32 N.E., S.E., 33 N.E. **Middlesex**, 10 S.W., S.E., 19 S.E. **Surrey**, 19 S.W., 25 N.W., N.E., S.W. 1*s.* each.

25-inch—Parish Maps, revised:—

ENGLAND AND WALES:—**Durham**, VIII. 10; XIV. 7; XXXIII. 11; XXXIV. 6; XXXVI. 3, 4, 5, 6, 8; XXXVII. 1, 2; XXXIX. 10, 11. **Essex**, XIII. 12; XV. 14, 15; XXIII. 1, 2, 5, 7, 8, 9, 10; XXIV. 1, 2, 3, 7, 13; XXV. 2, 5, 6, 7, 12; XXVI. 3, 5, 6, 9, 15; XXXV. 8, 16; XXXVI. 1, 13, 15; XLV. 3, 4, 7; XLVI. 2, 3, 6, 9, 10; LII. 4; LV. 6, 9, 12, 15, 16; LVI. 5; LXIII. 8, 11, 13, 15, 16; LXIV. 1, 2, 5, 6, 9; LXX. 8; LXXI. 7, 9, 10, 13, 14; LXXII. 2, 6; LXXVI. 6; LXXVIII. 5; LXXIX. 1, 4, 9; LXXXIII. 12; LXXXV. 2, 4. **Hampshire**, XXI. 6, 14; LXII. 1, 5, 6, 12, 14; LXIII. 8, 10, 12, 13, 14, 15; LXIV. 7, 9, 10, 14, 15, 16; LXV. 8, 15; LXVIII. 16; LXXIV. 3; LXXVI. 2, 3, 4. **Kent**, VIII. 8, 9, 10, 11, 12, 13, 16; X. 12; XI. 8, 10; XXXI. 7, 8, 11, 14, 15, 16; XXXII. 9, 10, 11; XLII. 1, 5, 8; LII. 15; LX. 7, 10, 16; LXII. 2, 8, 12, 13, 15. **Northumberland**, XLII. 14, 15; XLIII. 10, 11; XLIX. 9; LI. 2, 3, 4, 6, 7, 8, 12, 15; LII. 1, 6, 10, 12, 14, 15, 16; LIII. 1, 3, 6, 8, 10, 14; LIV. 5, 6; LV. 6, 7; LVIII. 2, 8, 11, 12; LIX. 15; LX. 1, 3, 4, 5, 9; LXI. 3, 4; XCVI. 2, 5; XCVII. 1. **Surrey**, XIII. 2; XXXVII. 4, 8; XXXIX. 14; XLV. 1, 3, 5, 9, 11, 12. **Sussex**, XIII. 8, 16; XIV. 1, 2, 3, 5, 6, 7, 10; XXII. 1, 2, 4, 5, 8, 11; XXIII. 4, 7. 3*s.* each.

(*E. Stanford, Agent.*)

AFRICA.

Africa. **Herfst.**

Reference Map of the Orange Free State, reduced from the Ordnance Map as compiled by order of the Government of the O.F.S., with all the recent improvements and additions, by J. J. Herfst. Scale 1: 380,160 or 6 stat. miles to an inch. *Presented by the Orange Free State Government, through Sir W. Dunn, Bart., M.P.*

This map has been produced by photography, and is a reduction of the large map of the Orange Free State which has been compiled by the order of the Government. It contains a larger amount of detail than has previously been given on any map of this State, but in its present form—a blue print—the hills are but faintly indicated.

AMERICA.

Canada. **Geological Survey of Canada.**

Geological and Topographical Map of the Northern Part of the Lake of the Woods and Adjacent Country. Scale 1: 126,720 or 2 stat. miles to an inch. Geologically surveyed by A. C. Lawson, M.A. Compiled and drawn by A. E. Barlow, B.A. Additions by W. J. Wilson, 1897. Geological Survey of Canada. *Presented by the Geological Survey of Canada.*

GENERAL.

General Atlas. **W. & A. K. Johnston.**

Our Empire Atlas, showing British Possessions at Home and Abroad. Fifty-nine plates and complete Index, with introduction by C. P. Lucas, B.A. 1897. Messrs. W. & A. K. Johnston, Edinburgh and London. *Presented by the Publishers.*

Historical Geography. **Poole.**

Historical Atlas of Modern Europe from the Decline of the Roman Empire, comprising also maps of parts of Asia and of the New World, connected with European History. Edited by Reginald Lane Poole, M.A., PH.D. Lecturer in Diplomatic in the University of Oxford. Part ix. Oxford: The Clarendon Press; London,

Edinburgh, Glasgow, and New York: Henry Frowde, M.A.; Edinburgh: W. & A. K. Johnston. 1897. *Price* 3*s.* 6*d.* each part. *Presented by the Clarendon Press.*

Part ix. contains the following maps: No. 4, Europe in the time of Charles the Great, by Reginald Lane Poole, M.A., PH.D.; No. 46, Hungary, 1526–1699, by R. Nesbit Bain; No. 53, France, Lotharingia, and Burgundy in the Eleventh and Twelfth Centuries, by Walter E. Rhodes, M.A. Each map is accompanied by letterpress.

World. **Berghaus.**

Chart of the World. XII. Edition. Dr. Herm. Berghaus. Gotha: Justus Perthes, 1897. *Price* 14 *marks.*

This is an entirely new edition of Berghaus's well-known Chart of the World. On it are shown all tracks followed by all the principal steamship lines and sailing vessels, the outward and homeward tracks being distinguished by the colour of the arrows indicating the direction. Currents are shown and their velocities given; railways and submarine telegraph lines are laid down, and the positions of coaling-stations, docks, etc., are shown. In addition to the vast amount of information given on the principal map, there are insets showing the principal telegraph lines of the World, co-tidal lines, the World in hemispheres, on Lambert's polar projection, showing steam navigation and railroads round the World, and a general wind chart. At the foot of the map copious notes are given explaining the symbols employed, and general information with regard to steamship lines. The map is beautifully drawn, and is equally well suited for general reference in the library, merchant's office, or schoolroom.

PHOTOGRAPHS.

Baluchistan. **Yate.**

Eleven Photographs of Baluchistan, taken by Major A. C. Yate. *Presented by Major A. C. Yate.*

This is an exceedingly interesting set of photographs, consisting of the following: (1) Distorted rails due to earthquake, December 20, 1892, at Old Chaman; (2) Railway terminus at Chaman; (3) Railway plant for line to Kandahar; (4) Telegraph plant for line to Kandahar; (5) Kojhak tunnel; (6) Sanzal; (7) Black hair tents of nomads; (8) Interior ground-plan of black hair tent; (9) Locusts at work; (10 and 11) Showing effect of earthquake near Old Chaman.

Central Asia.

Thirteen Photographs of Sikkim and Tibet. *Presented by Miss S. M. Taylor.*

This interesting series contains the following photographs taken in Sikkim and Tibet: (1) Gnatong, altitude 12,350 feet; (2) Lake Bedentzo, between the Tukola and Jelapla; (3) Tent hill; (4) The main street of the Trade Mart of Yatung, Tibet; (5) View from the Commissioner's balcony, Trade Mart, Yatung; (6) Sida Dhurki—chief Tibetan at the Trade Mart; (7) View from Yatung Trade Mart of the wall, a quarter of a mile off; (8) Small fortifications to the right of the temple; (9) View taken from the further side of the wall and looking towards Sikkim; (10) The temple; (11) View from the temple of Rinchingong in the valley below; (12) Further temple, considerably above the altitude of the first.

New South Wales.

Twelve Photographs, showing water issuing from various artesian bores in New South Wales. *Presented by Joseph Brooks, Esq.*

These photographs illustrate the progress that has been made in New South Wales with artesian wells. The particulars of depths, amount of flow, temperature, etc., are given on each photograph. They consist of the following: Burrenbilla bore; Lila springs, Cutta bulla; Lissington bore; Bore No. 3; Charlotte Plains bore, No. 1; Charlotte Plains bore, No. 2; Camden Park bore; Noorama, No. 1 bore; Noorama, No. 2 bore; Thurlagoon bore, No. 11; Cunnamulla bore; Claverton Downs bore, No. 2.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

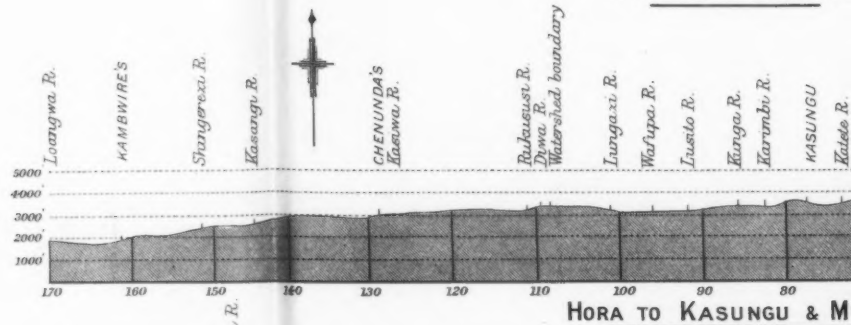
31° 32°

12°

13°

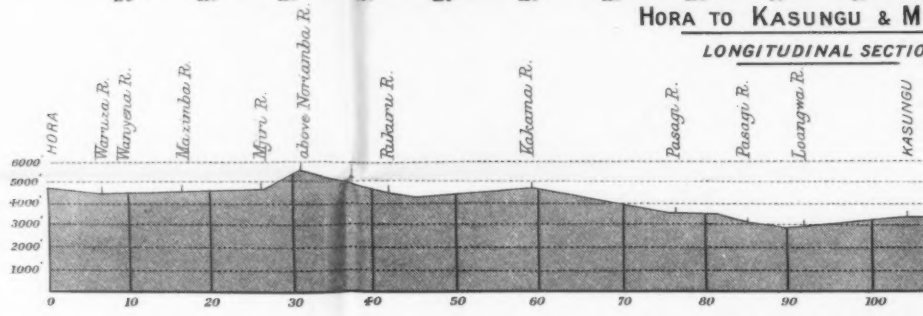
LOANGWA RIVER TO KOTA

LONGITUDINAL SECTION



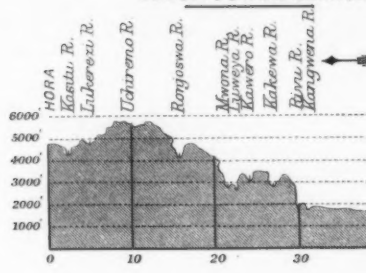
HORA TO KASUNGU & M

LONGITUDINAL SECTIO



HORA TO BANDAWE

LONGITUDINAL SECTION



SCALES, HOR. 20 MILES = 1 INCH, VER

MAP OF
THE NORTH EASTERN PART
OF
BRITISH CENTRAL AFRICA
WEST OF LAKE NYASA

SURVEYED BY R. I. MONEY AND LIEUT. E. C. T. BISCOE, R.N.

Scale of Miles

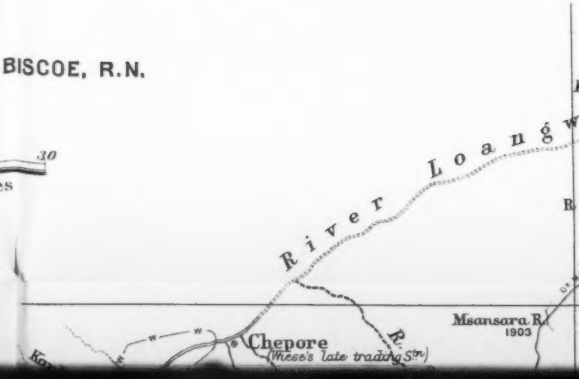
10 5 0 10 20 30

Natural Scale 1:750,000 or 1 inch=11·84 miles

Author's Routes

Reference.

—L—L— Livingstone 1863
—S'—S'— Jas. Stewart 1878
—S—S— A. Sharpe 1890
—T—T— J. Thomson 1890
—W—W— C. Wiese 1885-91

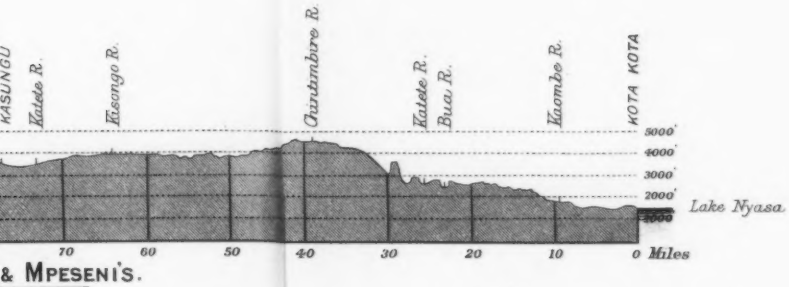


32°

33°

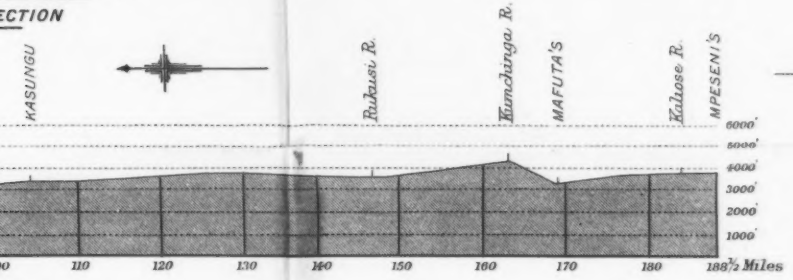
KOTA KOTA

TION



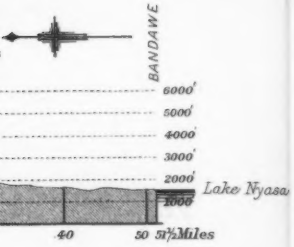
& MPESENI'S.

ECTION



AWE.

CTION



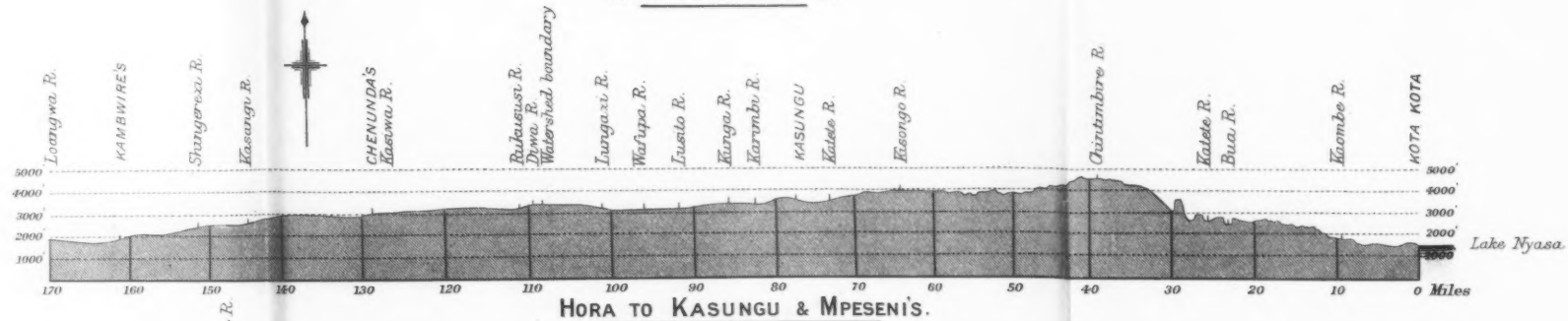
VERT. 7500 FEET = 1 INCH.

R. Rukuru
R. Rukuru
R. Sambuzi
Mabamba
ANGONI
R. Kasitu
Mt. Njewe
Chipatula
R. Lingangwa
Ongonomo's Kr.
Jitimira
Hora Hill
Hora
4710
Large cultivated plain
Zuka-zuka's Kr.
R. Lukeri
Ichiremo R.
Rongowa R.
Kasitu R.
3970
Msaruru's Kr.
Mangerosa R.
Waruza R.
4488
Wanyera R.
cultivated land
Garuka's Kr.
Zicono's Kr.
Mosoro's Kr.
4300
Mazimba R.
Chirumba's Kr.
Pararuina R.
Manwaya
Kadambo's Kr.
Marara R.
Valley
Changaxi's Kr.
Mjuri R.
WA
4675
Komtami
R. Marandu
4800
R. Berere
3400
Namamba R.
R. Recoza
water hole
R. Recoza
4508
R. Rukuru
R. Kamata
Madura
4450
granite hill
hill with castellated top
Disused iron smelting furnaces
R. Kakama
Mwasi's
4100
R. Massusu
Forest
R. Kasuku
R. Mlenje
R. Msenda 4050
Granite hills
R. Pasagi
R. Kachakaiyu
R. Pasagi
Loangwa R.
at Lake Bwesa
R. Kasanga
2977
3850
Mombe Hills
4880
3800
R. Hangari
Nombe-Rume Hills
Camp
Kasura's Kr.
Thanga's Kr.
Saturwiwa's Kr.
1923
Kambwire's
1890
R. Mdure
1903
R. Rukusi
R. Stungeresa
Mpangwe Hill
R. Ungazi
Mwasi's Brother's Kr.
fine cultivated plain
Chibisa's Kr.
R. Idamba
Kalete R.
Kasungu
Mwasi's Kraal
3325
Kasungu Hill
4754
Mawimbi's Kr.
Rough hilly country thickly wood

31° 32°

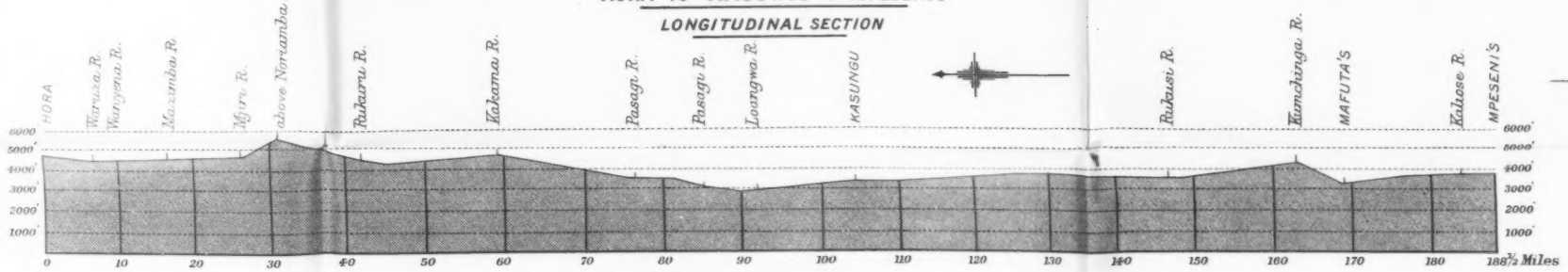
LOANGWA RIVER TO KOTA KOTA

LONGITUDINAL SECTION



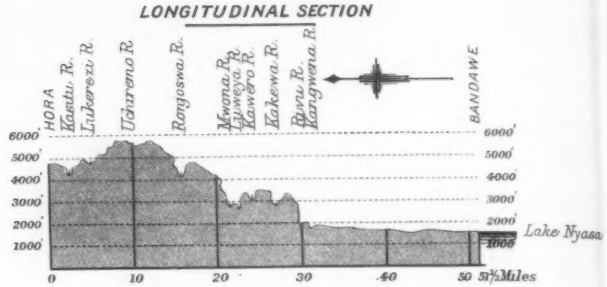
HORA TO KASUNGU & MPESENI'S.

LONGITUDINAL SECTION



HORA TO BANDAWE.

LONGITUDINAL SECTION



SCALES, HOR. 20 MILES = 1 INCH, VERT. 7500 FEET = 1 INCH.

MAP OF

NORTH EASTERN PART

OF

H CENTRAL AFRICA

EST OF LAKE NYASA

R. I. MONEY AND LIEUT. E. C. T. BISCOE, R.N.

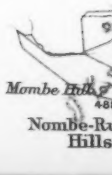
Scale of Miles

0 10 20 30

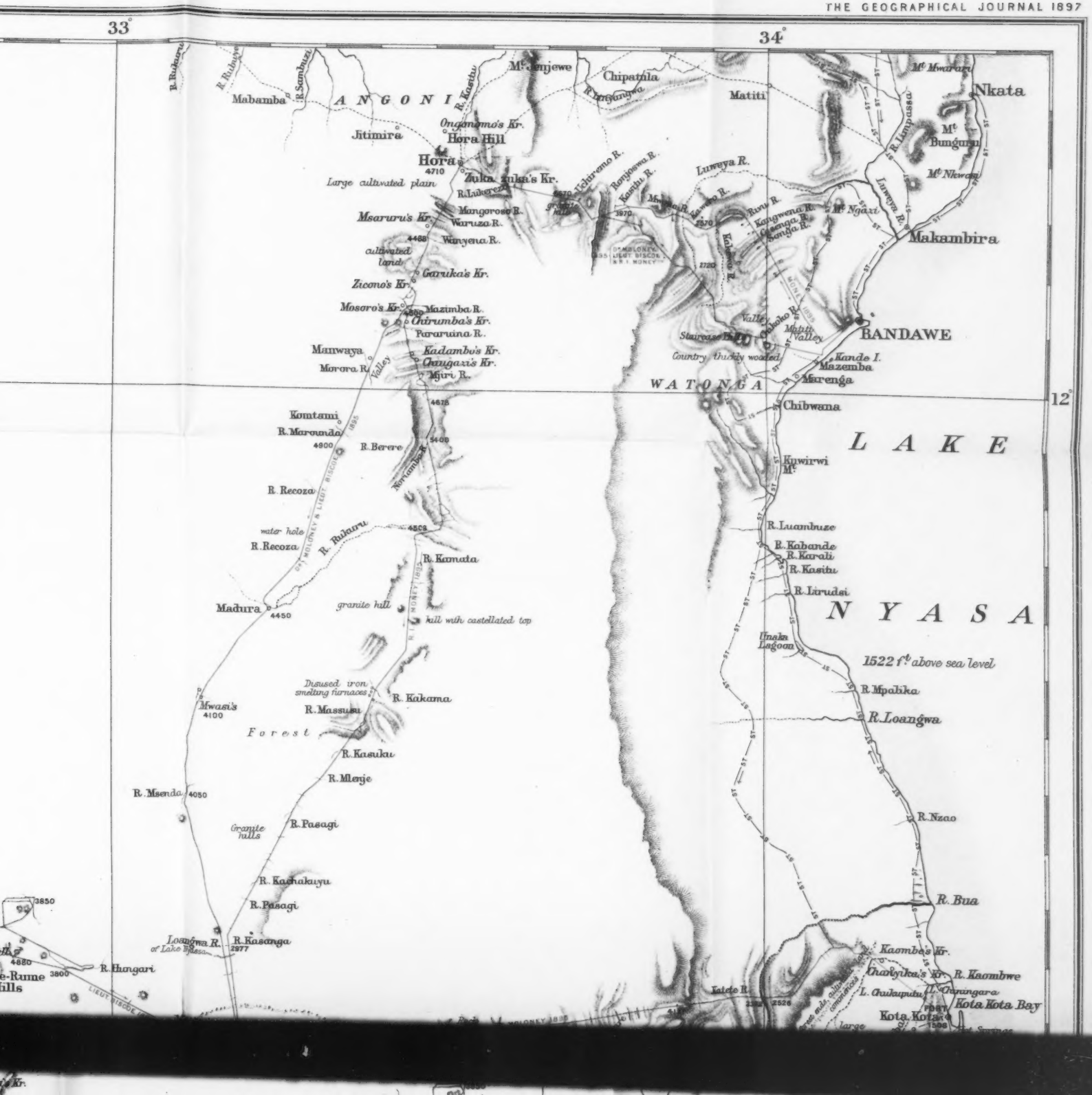
ural Scale 1:750,000 or 1 inch-11·84 miles

Author's Routes

Reference.



SURVEYED BY R. I. MONEY AND LIEUT. E. C. T. BISCOE, R.N.


33°
34°
12°
ANGONI
WATONGA
NYASA
LAKE
Mabamba
R. Rukuru
R. Sambuzi
R. Kasitu
Mt. Jenjewe
Chipatula
R. Lungunya
Matiti
Mt. Mwarari
Nkata
R. Lumpasa
Mt. Bungaru
Mt. Nkwam
Jitimira
Ongomamo's Kr.
Hora Hill
Hora
4710
Large cultivated plain
Zuka, Zuka's Kr.
R. Lukeregi
Uchamo R.
Ronjowa R.
Kasitu R.
Luweya R.
Mt. Ngazi
Makambira
Msaruru's Kr.
Mangoroso R.
Waruza R.
Wanyena R.
4468
cultivated land
Garuka's Kr.
Zicomo's Kr.
Mosoro's Kr.
Mazumba R.
Chirumba's Kr.
Pararuina R.
Manwaya
Marora R.
Valley
Kadamba's Kr.
Changazi's Kr.
Mjuri R.
Kamtsmi
R. Marounda
4900
R. Berere
5400
Kamtambo R.
4678
R. Recoza
water hole
R. Rukuru
4568
R. Kamata
Madura
4450
granite hill
hill with castellated top
Disused iron smelting furnaces
R. Kakama
Mwasi's
4100
R. Massusu
Forest
R. Kasuku
R. Mlerje
R. Msenda
4050
Granite hills
R. Pasagi
R. Kachakayu
R. Pasagi
Loangwa R.
of Lake Nyasa
R. Kasanga
2977
R. Hangari
3850
4880
3800
Valley
Staircase Pass
Country thickly wooded
Kande I.
Mazemba
Marenga
Chibwana
Kuwirwi
Mt.
R. Luambuze
R. Kabande
R. Karali
R. Kasitu
R. Lirudsi
Unaka Lagoon
1522 ft. above sea level
R. Mpabika
R. Loangwa
R. Nzao
R. Bua
Kasombe's Kr.
Chaliyika's Kr.
R. Kasombwe
L. Chaikapulu
L. Ngangara
Kota Kota Bay
Kota Kota
Point
Laiete R.
2526
2320
2720
2970
3970
4710
Kalonga Rd.
Ruru R.
Kongwena R.
Lisenga R.
Bunga R.
Luweya R.
Kabuko R.
Mpiti Valley
Mt. Ngazi
Mt. Nkwam
Mt. Bungaru
Mt. Mwarari
R. Lumpasa
R. Kasitu
R. Sambuzi
R. Rukuru
Ronjowa R.
Uchamo R.
Kasitu R.
Luweya R.
Kongwena R.
Lisenga R.
Bunga R.
Kabuko R.
Mpiti Valley
Staircase Pass
Valley
Marora R.
Manwaya
Mjuri R.
Changazi's Kr.
Kadamba's Kr.
Pararuina R.
Chirumba's Kr.
Mazumba R.
Mosoro's Kr.
Zicomo's Kr.
Garuka's Kr.
cultivated land
Wanyena R.
Waruza R.
Mangoroso R.
Msaruru's Kr.
R. Lukeregi
Zuka, Zuka's Kr.
Large cultivated plain
Hora
4710
Hora Hill
Ongomamo's Kr.
Jitimira
Mabamba
R. Rukuru
R. Sambuzi
R. Kasitu
Mt. Jenjewe
Chipatula
R. Lungunya
Matiti
Mt. Mwarari
Nkata
R. Lumpasa
Mt. Bungaru
Mt. Nkwam
Mt. Ngazi
Makambira
Luweya R.
Kongwena R.
Lisenga R.
Bunga R.
Ruru R.
Kabuko R.
Valley
Mpiti Valley
Staircase Pass
BANDAWE
Country thickly wooded
Kande I.
Mazemba
Marenga
WATONGA
Chibwana
LAKE
Kuwirwi
Mt.
R. Luambuze
R. Kabande
R. Karali
R. Kasitu
R. Lirudsi
NYASA
Unaka Lagoon
1522 ft. above sea level
R. Mpabika
R. Loangwa
R. Nzao
R. Bua
Kasombe's Kr.
Chaliyika's Kr.
R. Kasombwe
L. Chaikapulu
L. Ngangara
Kota Kota Bay
Kota Kota
Point
Laiete R.
2526
2320
2720
2970
3970
4710
Kalonga Rd.
Ruru R.
Luweya R.

SURVEYED BY R. I. MONEY AND LIEUT. E. C. T. BISCOE, R.N.

Scale of Miles

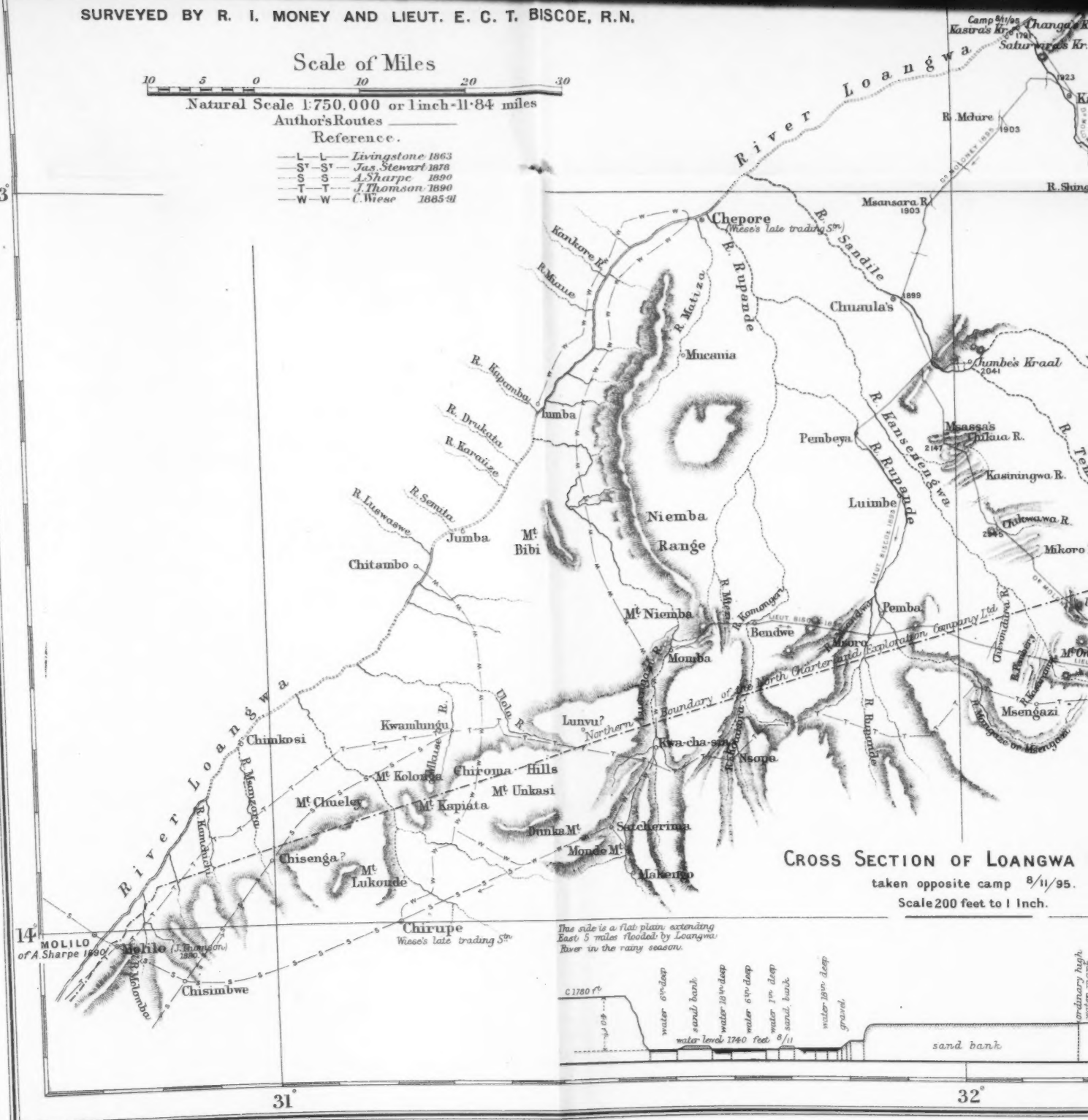
10 5 0 10 20 30

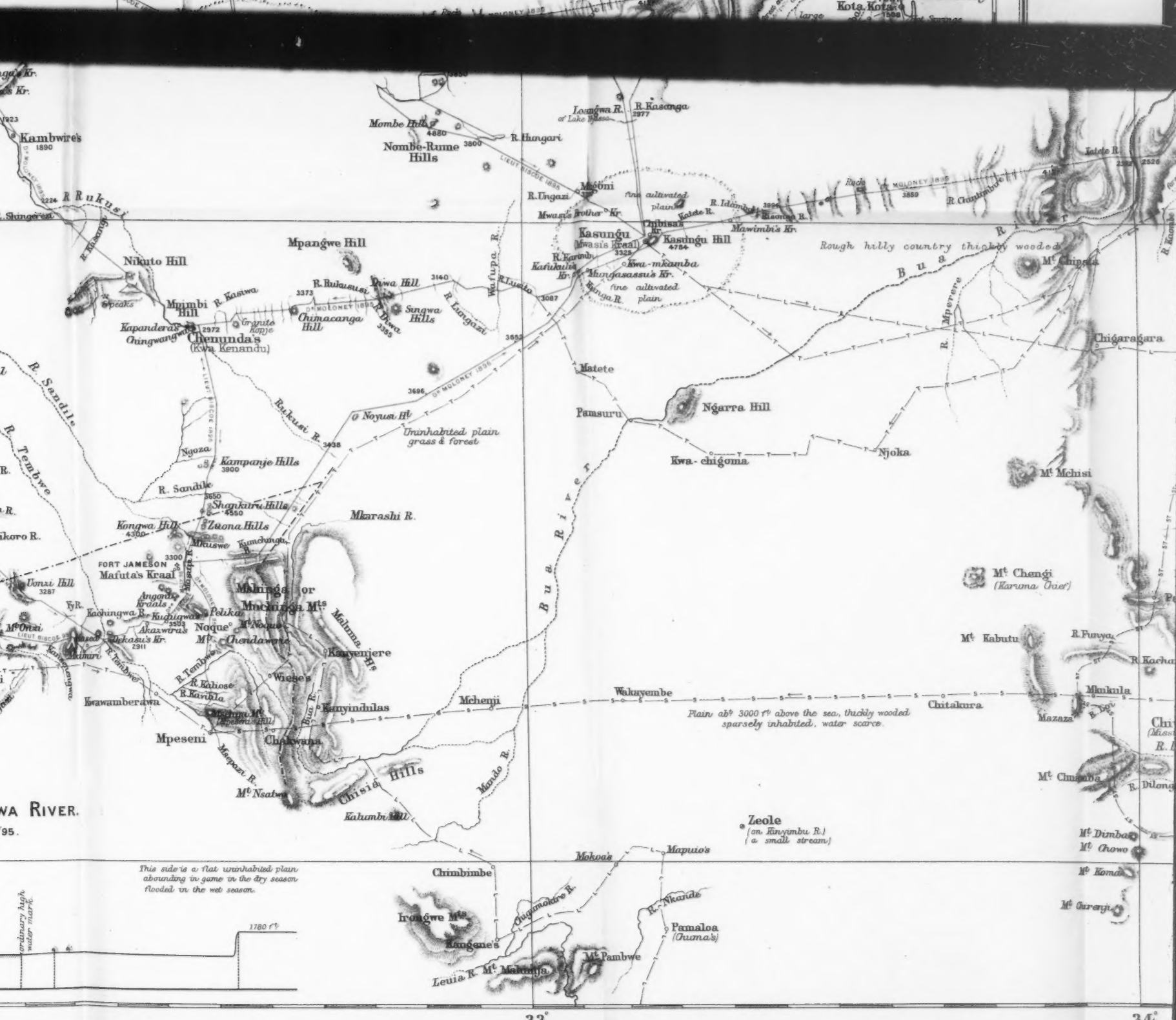
Natural Scale 1:750,000 or 1 inch=11·84 miles

Author's Routes

Reference.

—L—L— Livingstone 1863
—S'—S'— Jas. Stewart 1878
—S—S— A. Sharpe 1890
—T—T— J. Thomson 1890
—W—W— C. Wiese 1885-91





Published by the Royal Geographical Society

BY R. I. MONEY AND LIEUT. E. C. T. BISCOE, R.N.

Scale of Miles

5 0 10 20 30

Natural Scale 1:750,000 or 1 inch=11·84 miles

Author's Routes

Reference.

—L—L— Livingstone 1863
—Sᵀ—Sᵀ— Jas. Stewart 1878
—S—S— A. Sharpe 1890
—T—T— J. Thomson 1890
—W—W— C. Wiese 1885-91

River Loangwa

Camp 8/11/95
Kasura's Kr.
Changa's Kr.
Saturwara's Kr.
1791
1823
Kambwire's
1890
R. Mdure
1903
R. Rukusi
2224
R. Slungeresa
Msansara R.
1903
Chepore
(Wiese's late trading Stn)
R. Sandile
R. Kankure R.
R. Miaue
R. Matizo
R. Rupende
Chuzula's
1899
Mpangwe Hill
Nikuto Hill
Mpimbi Hill
R. Kasiwa
R. Rukususi
3373
Chimacanga Hill
Kapanderas
Chingwangwala
2972
Granite Kopje
Chenunda's
(Kwa Kenandu)
Mucania
Chumbe's Kraal
2041
R. Kapamba
Jumba
R. Drukata
R. Karaiize
R. Kansengwa
Pembeya
Msassa's
Chilaia R.
2147
Kasiningwa R.
Luimbe
R. Tembwe
Ngoza
Kampanje Hills
3900
R. Sandile
3650
Shankaru Hills
4550
Mkarashi
Rukusi R.
3438
Noyusa R.
R. Luswaswe
R. Semita
Jumba
Mt. Bibi
Niemba Range
Chitambo
Chukwa wa R.
2445
Mikoro R.
Kongwa Hill
4300
Zuona Hills
Mlaswe
Kumchinga R.
FORT JAMESON
3300
Mafuta's Kraal
R. Musyasi
Donzi Hill
3287
Mt. Niemba
R. Kamangeri
Bendwe
Pemba
R. Msoro
Momba
Angoni Kraals
Iyr.
Kachangwa R.
Kuchigwara
Polika
Noque
Mt. Noque
Chendawore
Malinga or Mokinga Mts
Malama Hills
Kanyemjere
Mt. Onzi
Akazwiras
Nkasa's Kr.
2911
Mkwiri
R. Tembwe
Msengazi
R. Kahose
R. Kavala
Kwawamberawa
Wiese's
Kanyindulas
Mpeseni
Chakowana
Chisia Hills
Kahumbi Hills
Mt. Nsatwa
Margazi R.
Kwamlungu
Chimkosi
R. Mamzogwa
Lunvu?
Northern
Kwa-cha-sha
Nsopa
Mt. Kolonga
Chiroma Hills
Mt. Unkasi
Mt. Chueley
Mt. Kapiata
Dunka Mt.
Satcherima
Monde Mts
Makenga
Chisenga?
Mt. Lukonde
Chirupe
Wiese's late trading Stn
Kusimbwe
Boundary of the North Charterland Exploration Company Ltd.

CROSS SECTION OF LOANGWA RIVER.

taken opposite camp 8/11/95.

Scale 200 feet to 1 Inch.

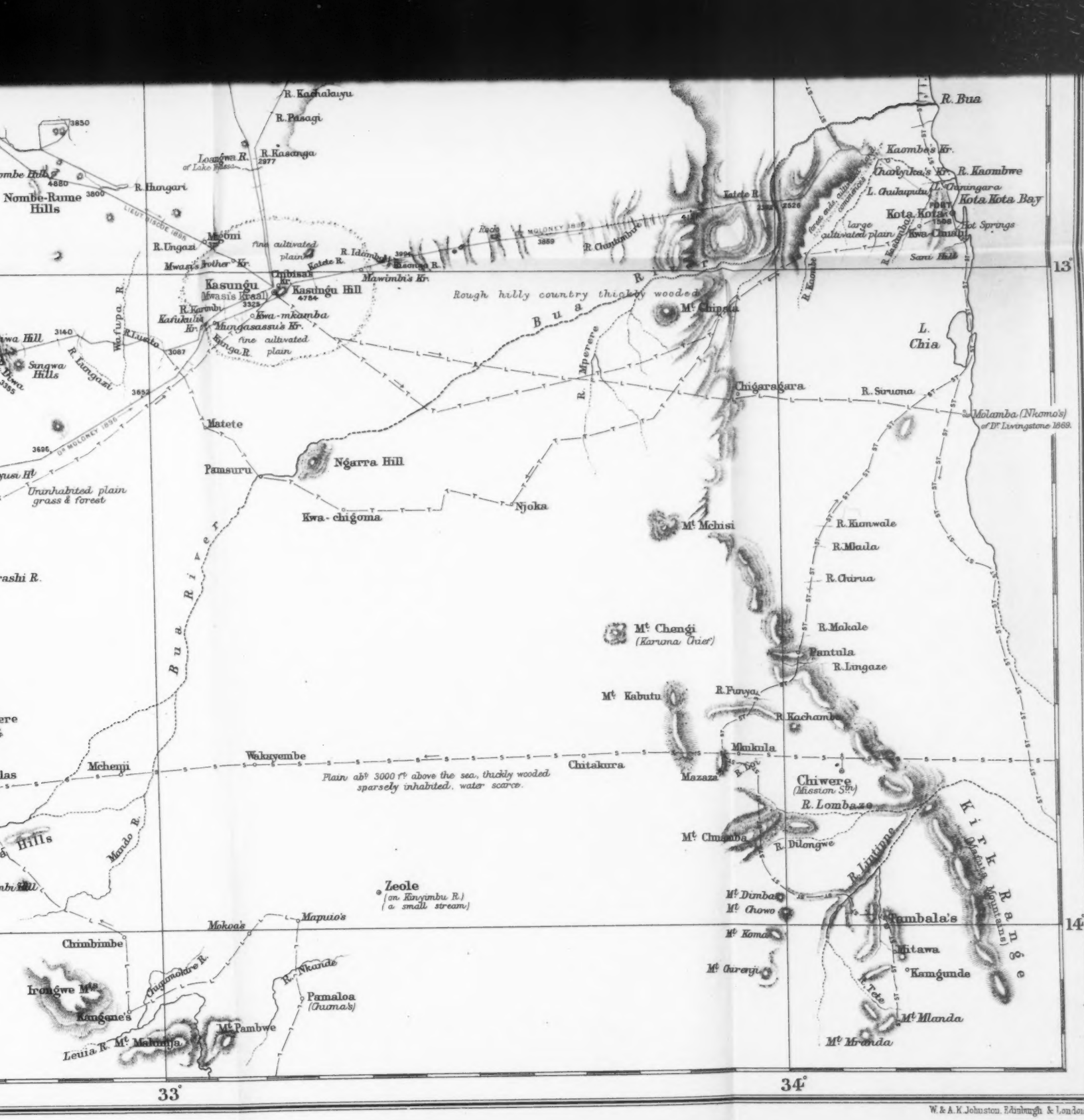
This side is a flat plain extending East 5 miles flooded by Loangwa River in the rainy season.

This side is a flat uninhabited plain abounding in game in the dry season flooded in the wet season.

C 1780 ft.
10 ft.
water 6 in deep
sand bank
water 18 in deep
water 6 in deep
water 1 in. deep
sand bank
water 3 in. deep
gravel
water level 1740 feet 8/11
sand bank
ordinary high water mark
1780 ft.

31° 32°

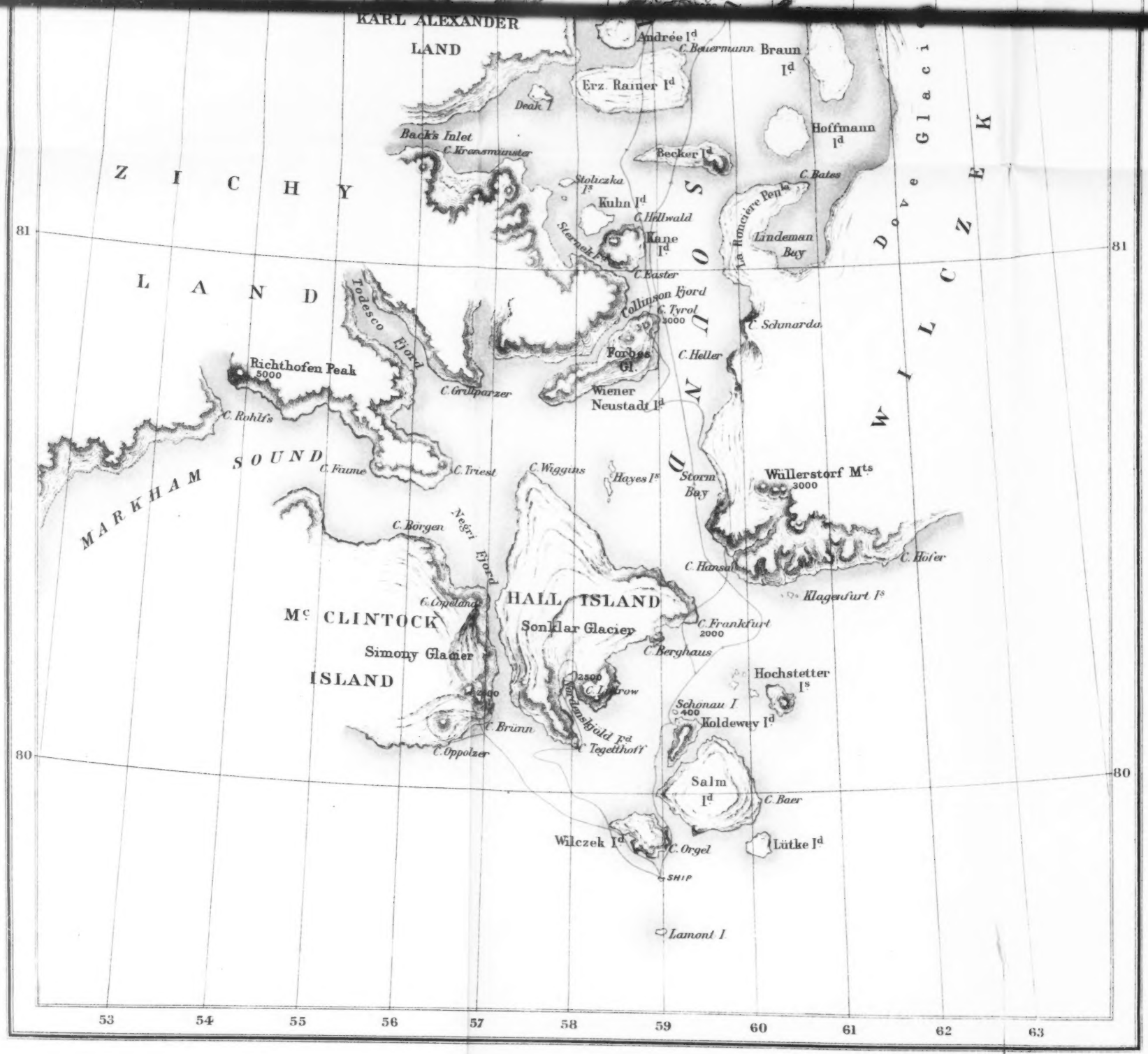
Published by the Royal Geographical Society



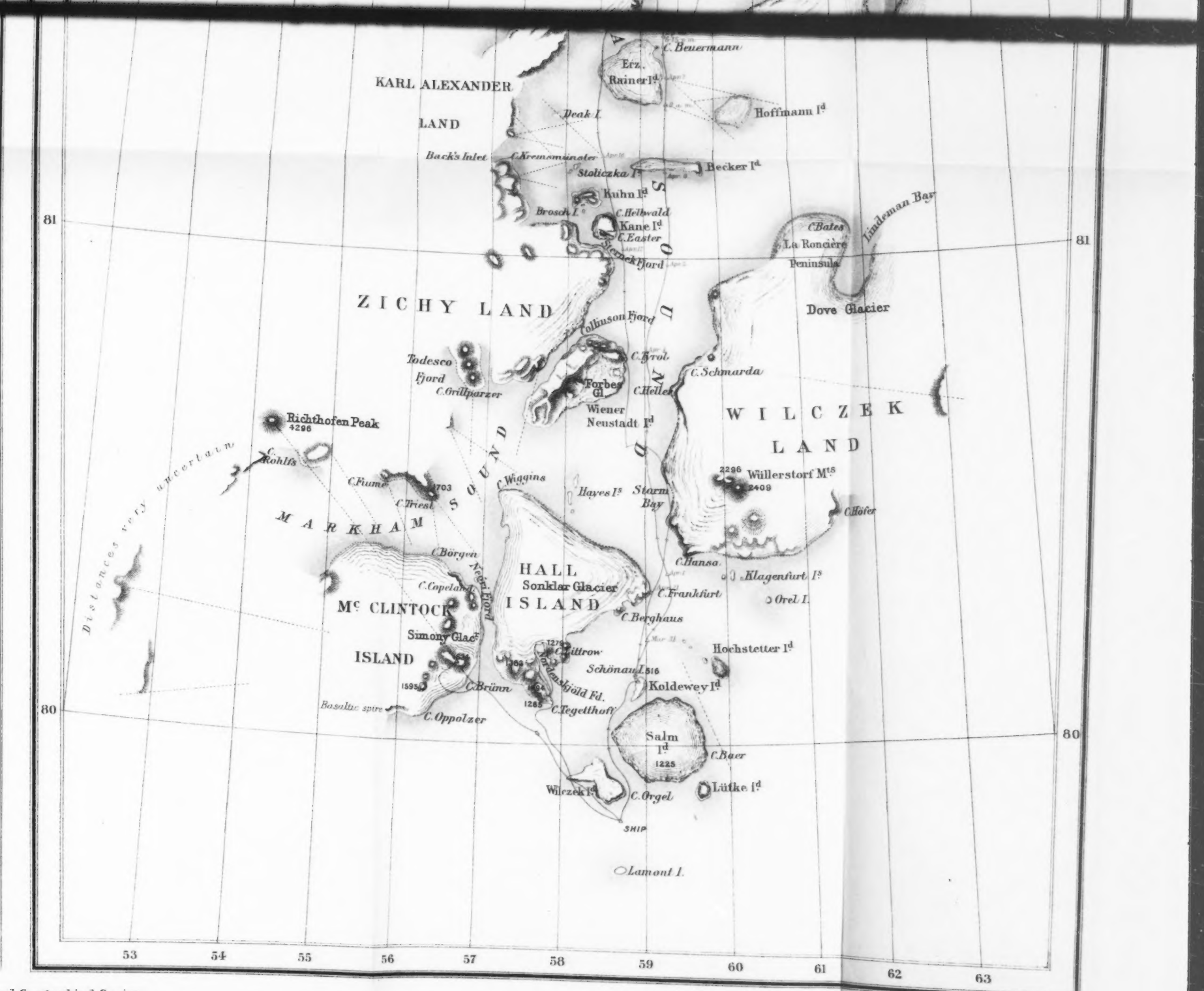
W. & A. K. Johnston, Edinburgh & London

MAP OF
KAISER FRANZ JOSEF LAND
From a Survey by
JULIUS PAYER
Enlarged from the Original Map in Payer's "Die Österr-Ungar Nordpol Expedition."
Scale of Miles
10 5 0 10 20 30
Natural Scale 1:1,000,000 or 15·78 miles - 1 inch
Heights in Vienna feet
50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66
82
81
PETERMANN LAND
KING OSCAR LAND
C. Wien (Vienna)
C. Sherard Osborne
C. Flagely
C. Buda Pesth
C. Ruth
C. Germania 1200
CROWN PRINCE RUDOLF LAND
Tephitz Bay
Middendorf Glacier
C. Auk
C. Brorok
C. Habermann
RAWLINSON SOUND
Hohenlohe Id
C. Schrötter
Freeden Id
C. Felder
C. Böhm
Coburg Is
KARL ALEXANDER LAND
Andrée Id
C. Bauermann
Braun Id
Erz. Rainer Id
Deak I.
Hoffmann Id
Back's Inlet
C. Krensmünster
Becker Id
C. Bates
Stoliczka Is
Kuhn Id
C. Hellwald
Kane Id
La Ronciere Penk
Lindeman Bay
C. Easter
Collinson Fjord
C. Tyrol
Dove Glacier
ZICHY LAND
FRANZ JOSEF LAND
KARL ALEXANDER

MAP OF
KAISER FRANZ JOSEF LAND
Reconstructed from the Original Survey of
JULIUS PAYER
BY
RALPH COPELAND, Astronomer Royal of Scotland.
Scale of Miles
Natural Scale 1:1,000,000 or 15·78 miles = 1 inch
Heights in Vienna feet
50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66
82
81
C. Wien (Vienna)
PETERMANN LAND
KING OSCAR LAND
C. Sherard Osborne
C. Flagely
A U S T R I A
C. Germania
C. Säulen
CROWN PRINCE RUDOLF LAND
Teplitz Bay
Middendorf Glacier
C. Rath
Island doubtful
C. Auk
C. Brorok
C. Habermann
C. Schrotter
Hohenlohe Id
Freeden Id
C. Felder
Coburg I.
(& small Islands near)
C. Bauermann
Erz. Rainer Id.
KARL ALEXANDER LAND
Deak I.
Hoffmann Id
Back's Inlet
C. Kremsmünster
Stoliczka I.
Becker Id
Kuhn Id
Brosch I.
C. Helwald
Kane Id
C. Easter
Wiener Fjord
C. Bates
La Ronciere Peninsula
Lindeman Bay



Published by the Royal G



val Geographical Society

W. & A. K. Johnston, Lithographers, Edinburgh & London.